

THE RELATIONSHIP BETWEEN DEPRESSIVE SYMPTOMS, RUMINATION
AND SENSITIVITY TO EMOTION SPECIFIED IN FACIAL EXPRESSIONS

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Abstract

In social interactions it is important for perceivers to be able to differentiate between facial expressions of emotion associated with a congruent emotional experience (genuine expressions) and those that are not (posed expressions). This research investigated the sensitivity of participants with a range of depressive symptom severity and varying levels of rumination to the differences between genuine and posed facial expressions. The suggested mechanisms underlying impairments in emotion recognition were also investigated; the effect of cognitive load (as a distraction from deliberate processing of stimuli) and attention, and the relationships between mechanisms and sensitivity across a range of depressive symptoms and level of rumination. Participants completed an emotion categorisation task in which they were asked if targets were showing either happiness or sadness, and then if targets were feeling those emotions. Participants also completed the same task under cognitive load. In addition, a recognition task was used to measure attention. Results showed that when making judgements about whether targets were feeling sad lower sensitivity was related to higher levels of depressive symptoms, but contrary to predictions, only when under cognitive load. Depressive symptoms and rumination were not related to higher levels of bias towards sad expressions. Recognition did not show a relationship with sensitivity, rumination or depression scores. Cognitive load did not show the expected effects of improving sensitivity but instead showed lower sensitivity scores in some conditions compared to conditions without load. Implications of results are discussed, as well as directions for future research.

1. INTRODUCTION

The identification of emotion plays an important role in ensuring successful interactions in the social environment and impairments in the recognition of emotion have been associated with impairments in social behaviour (Leppenen & Hietanen, 2001). Depression is a disorder characterised by social dysfunction and individuals experiencing the disorder have been shown to have difficulties in identifying facial expressions of emotion (Gur, Erwin, Gur, Zwi, Heimberg, & Kraemer, 1992; Hale, 1998; Joormann & Gotlib, 2006; Persad & Polivy, 1993; Surguladze et al., 2004). Rumination, associated with depression, has also been associated with impairments in emotion recognition (Johnston, Carter & McLellan, in press; Raes, Hermans, & Williams, 2006). Rumination is a response to the experience of depressive symptoms (Lyubomirsky, Caldwell, & Nolen-Hoeksema, 1998; Nolen-Hoeksema, 1991) and it is theorised that this relationship itself impacts social judgements. It has been suggested that these impairments are related to a mood congruence effect, and that those diagnosed with depression attend more to negative stimuli which is associated with their underlying mood state (Persad & Polivy, 1993). Alternatively it has been hypothesised that those experiencing states of sadness (including chronic states), have impairments in the manner they process non-verbal information (Ambady & Gray, 2002). Further investigation of the mechanisms underlying emotion recognition deficits in individuals with depression and who engage in rumination will be useful to understand the associated social dysfunction.

One aspect of fundamental importance to functional emotion recognition has received little research attention, that is, the ability to recognise the actual underlying emotional experience of other people. People have the ability to separate their

underlying emotional experience from their outward expression of such experiences. Therefore individuals need to be sensitive to the differences between genuine facial expressions of emotion (displays associated with the congruent underlying emotional experience of a person) and posed expressions (displays not associated with the corresponding emotional state of a person), as these expressions contain information which perceivers can use to inform their behaviour in social interactions. The purpose of the present research was to contribute to the existing knowledge about emotion recognition in depression and rumination by examining sensitivity to the differences between genuine and posed facial expressions. The following sections of the present introduction will firstly outline the role of emotion recognition in social interactions. The state of current research relating to emotion recognition in individuals with depressive symptoms and associated ruminative processing styles will then be presented. The introduction will then outline the importance of considering the implications of differentiating between genuine and posed facial expressions.

1.1 Emotion Recognition and its Role in Social Interactions

The emotional experience of humans is seen as being varied and complex. While the emotional experience of the individual has been defined in different ways, the experience of emotion can be described broadly as the perception of a meaningful world that the perceiver is called to act upon (Frijida, 1986). Emotional experience is seen as an integral way in which people navigate their social environment. Emotions are regarded as strong regulators of both intrapersonal and interpersonal behaviour (Denham, McKinley, Couchoud, & Holt, 1990). Emotions are thought to be essentially automatic, involuntary, and quick reactions that help people interact in

their social relationships, helping to regulate and maintain these relationships (Keltner & Haidt, 1999). Social theories of the function of emotions make the assumption that people are social creatures, and therefore encounter issues related to survival in their relationships (Keltner & Haidt, 1999). Social interactions are highly important to humans and navigating the social environment successfully is a way to ensure positive outcomes for survival. Emotion recognition has been extensively studied in the literature in relation to the important role it plays in the social interactions of humans; being able to accurately identify emotions expressed by another is one of the abilities needed for successful social interaction (Blair, 2003; Matsumoto et. al, 2008). It is theorised that expressions of emotion aid individuals to know the emotions, beliefs and intentions of others; this information is then used to facilitate successful social interactions (Keltner & Haidt, 1999).

Emotion can be expressed through different mediums and there has been an interest in the expression of emotion through various facial, vocal and postural channels. There has been a particular focus on emotion conveyed thorough facial expressions. The nature of the face, in that it is highly visible and dynamic makes it an accessible and efficient medium for communicating emotion (Buck, 1994, Frijda & Mesquita, 1994). The ability to recognise facial expressions is important as these expressions provide information about emotions, intentions, and relationships with the perceiver and the environment (Matsumoto et. al, 2008). The ability to recognise displays of facial expressions of emotions has been shown to be almost universal (Ekman & Friesen, 1971, Ekman et al., 1987). This universal recognition has been demonstrated by showing that perceivers in one culture perform at better than chance levels when identifying emotions displayed by members of another culture (Ekman et al., 1987). Ekman and colleagues (1987) completed research in 10 different

countries and in 8 different languages; two of the countries included, Japan and Sumatra, are known to have significantly different attitudes to emotional expression than Western cultures. Due to the important social function of emotional expression, the universal ability to recognise facial expressions of emotions demonstrates that perceivers are able to use this skill to aid in successful social interactions.

Prototypical facial expressions are expressions associated with the experience of certain emotions, often termed basic emotions (e.g. happiness, anger, sadness, fear, surprise). However, as discussed facial expressions of emotions can communicate to the perceiver more than just the associated emotion. Facial expressions may not always be related to a congruent affective state. A facial expression of one emotion may be a mask for other underlying emotions, or a more neutral mode state (Ekman, Friesen, & O'Sullivan, 1988). One way to consider this distinction is by labelling facial expressions of emotion associated with the corresponding emotional experience as genuine expressions, and those expressions not associated with a congruent experience of emotion as posed expressions.

1.2 Depressive Symptoms and Emotion Recognition

Depression is a disorder characterised by affective disturbances, predominantly low mood and loss of pleasure in activities (anhedonia) (Felician & Arian, 2007). Depression as a disorder involves the experience of depressive episodes, in which depressive symptoms are actively experienced. The Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR) (American Psychiatric Association, 2000) criteria for a Major Depressive Episode outlines the symptoms associated with depressive episodes and when these symptoms are at a level of severity that they qualify for a formal diagnosis. The criteria for a Major Depressive

Episode outline that individuals must experience depressed mood most of the day and/or anhedonia and five or more of the following symptoms present nearly every day for at least two weeks, representing a change in functioning: 1) Significant weight loss when not dieting or weight gain (a change of more than 5% of body weight in a month), or decrease or increase in appetite; 2) Insomnia or hypersomnia; 3) Psychomotor agitation or retardation (observable by others); 4) Fatigue or loss of energy; 5) Feelings of worthlessness, or excessive or inappropriate guilt; 6) Diminished ability to think or concentrate, or indecisiveness; 7) Recurrent thoughts of death, recurrent suicidal ideation, or suicide attempts or a specific plan for committing suicide.

While a diagnosis of a depressive disorder is made according to the DSM-IV-TR guidelines, depressive symptoms can be measured as dimensional constructs using psychometric measures. Such measures indicate the presence of symptoms and the severity of those symptoms in individuals without assigning a diagnosis. A diagnosis of depression indicates that depressive symptoms experienced by an individual are at a level of severity that causes significant impairments in the life of that individual. This current research is focused on symptoms of depression currently experienced by individuals, rather than focusing solely on a population which has a diagnosis attached to their symptoms. In examining depressive symptoms along a continuum, trends concerning increasing severity of symptoms can be observed.

Depression as a disorder is characterised by social dysfunction, as those experiencing depressive symptoms will often withdraw from social activities (Felician & Arean, 2007), leading to social isolation. As discussed emotion recognition has been shown to be important for successful social functioning and the relationship between depressive symptoms and emotional recognition has been an

area of interest. Research into emotion recognition has found impairments in this area are related to impaired social functioning (Leppenen & Hietanen, 2001), suggesting that it may be important to consider emotion recognition skills in populations experiencing difficulties in social functioning. Previous studies in the area of depression and emotion recognition have often examined two different populations, those with a clinical diagnosis of Major Depressive Disorder (which can be the presence of a single depressive episode, or recurrent episodes) and currently experiencing symptoms, or those experiencing symptoms of depression without a diagnosis.

Compared to healthy controls, individuals with a diagnosis of depression have been shown to be less accurate in recognising facial expressions of emotions (Persad & Polivy, 1993). Studies have reported that those experiencing depressive symptoms are found not to be impaired in all areas of emotion recognition, but more specifically show a negative bias when judging facial expressions (Gur, et al., 1992; Hale, 1998). For example those with diagnosed with depression have shown a tendency to categorise neutral facial expressions as being sad expressions and expressions of happiness as being neutral expressions (Gur et al., 1992). Individuals diagnosed with depression have also shown an attentional bias towards sad expressions (Gotlib et al., 2004). When presented with a neutral and a sad face, those diagnosed with depression were shown to selectively attend to the sad face, whereas non-psychiatric controls did not show this selective attention to sadness. These findings are clinically significant to the course of depression as greater perception of negative emotions have been associated with poorer depression outcomes (Bouhuys, Geerts, & Gordijn, 1999; Geerts & Bouhuys, 1998; Hale, 1998).

Much of the previous research has used prototypical facial expressions of emotions (highly recognisable expressions that are associated with specific emotions) that were typically posed. However, everyday perceivers may be exposed to a range of facial expressions, expressions of different intensities of an emotion, different aspects of the same emotion, or expressions that communicate different information. Research using prototypical facial expressions can only provide so much of an understanding of emotional processing in those experiencing depression symptoms. In order to gain a fuller understanding of impairments in emotional processing, research needs to consider aspects of emotion recognition other than the recognition of prototypical expressions. Individuals diagnosed with depression have been shown to require greater intensity of an expression to be able to identify it as being happy than healthy controls (Joormann & Gotlib, 2006; Surguladze et al., 2004). Surguladze and colleagues (2004) used faces morphed to show 50% intensity of emotional expression as well as 100% intensity expressions to study the ability of perceivers to identify less intense expressions. Compared with healthy controls those diagnosed with depression were less accurate in identifying the 50% intensity happy expressions as being happy. However, this study was conducted using computer morphed faces, which display expressions that are unlikely to be experienced during a real world social interaction. In summary previous research has shown that individuals experiencing depressive symptoms show an increased bias towards identifying expressions as sad and difficulty interpreting lower intensity positive emotion in facial expressions.

In many of the studies described above the ability of participants to label basic emotions displayed by facial expressions has been the focus of investigation. While recognising that certain facial expressions are associated with a corresponding

emotion is important for social interaction, there are other aspects of emotion recognition that are important for social functioning. Research needs to address the other aspects by using more ecologically relevant stimuli which could be encountered by perceivers in a social interaction, something lacking in the previous research methodology. The use of more ecologically relevant stimuli can allow for a better examination of impairments as they may elicit closer approximations to perceiver behaviour in the social environment.

1.3 Rumination Associated with Depression and Emotion Recognition

An important consideration in individuals experiencing symptoms of depression is the way in which a person responds to a depressive episode. A ruminative cognitive response style, referred to commonly as rumination or depressive rumination, is often engaged in by those as a response to the experience of symptoms of depression (Lyubomirsky, Caldwell, & Nolen-Hoeksema, 1998; Nolen-Hoeksema, 1991). Rumination as a response style is characterised by self focused attention on the negative aspects of one's self or life, repetitive thinking about one's negative emotions, and worrying about the causes and consequences of depressive symptoms, without any action to alleviate these symptoms (Lyubomirsky, Caldwell, & Nolen-Hoeksema, 1998; Nolen-Hoeksema, 1991). Rumination can be described as a style of analytical thinking, in that those engaging in rumination are preoccupied with passively analysing the causes of their depressive symptoms. A commonly used measure of rumination is the Ruminative subscale of Response Styles Questionnaire (RSQ-R; Nolen- Hoeksema, 1991). The RSQ-R has frequently been used in experimental studies to measure levels of rumination.

Rumination as a response style leads to the maintenance or increased severity of depressive symptoms (Grassia & Gibb, 2008; Nolen-Hoeksema, Morrow, & Fredrickson, 1993; Morrow & Nolen-Hoeksema, 1990). Individuals engaging in depressive rumination experience more depressive symptoms, a higher frequency of depressive episodes, longer episodes of depression and face a greater risk for future episodes of depression (Matheson & Anisman, 2003; Nolen-Hoeksema, 2000; Nolen-Hoeksema & Morrow, 1991; Spasojevic & Alloy, 2001). Rumination has therefore been shown to significantly affect the experience of depressive symptoms. Rumination is a cognitive process often associated with depressive symptoms and as it involves a preoccupation with negative emotions, it requires further consideration in regard to emotion recognition deficits. Rumination has been associated with a general negative effect on social skills. It has been shown that rumination leads to less effective interpersonal problem solving, and a bias towards negative information from interpersonal stories (Lyubomirsky & Nolen Hoeksema, 1995). This difficulty with problem solving has been theorised to be related to the poorer depression outcomes that are seen in those who engage in high levels of rumination.

Higher levels of rumination (in those diagnosed with depression) have been associated with higher levels of perception of negative emotion in schematic facial expressions (Raes, Hermans, & Williams, 2006). This effect still proved significant even when levels of depression, anxiety and dysfunctional attitudes were controlled for. The authors theorise that the attentional biases of depressive rumination are the causal mechanism behind biases in the perception of facial expressions in those with depressive symptoms. In line with theories that biases of attention are associated with emotion recognition difficulties, rumination was suggested as the process behind these biases. Rumination influences the focus of the individual and the analytical

thinking associated with it may affect the interpretation of information, and in turn the meaning of stimuli may be interpreted more negatively (Raes, Hermans, & Williams, 2006). Johnston, Carter and McLellan (in press) investigated whether sensitivity to differences between genuine (associated with a congruent underlying emotional state) and posed (not associated with a corresponding emotional state) facial expressions of happiness and sadness was related to rumination and depressive symptoms. The authors found that perceivers with higher levels of depressive symptoms were not more biased towards negative expressions, or more sensitive to the underlying emotion of sadness. The authors instead found higher bias scores for expressions of happiness than sadness across participants. However, higher rumination scores were associated with lower sensitivity and higher bias to expressions of sadness, when asked if expressions displayed sadness, rather than when asked if targets were actually feeling sad. This finding indicates that a relationship exists between level of rumination and sensitivity to genuine and posed facial expressions of emotion. There were no significant correlations with depression scores, although correlations with rumination were no longer significant once the effect of depression scores were partialled out. This finding indicates that there may be an interaction between rumination and depressive symptoms in relation to emotion sensitivity. The authors noted that the sample used had an overall low level of depressive symptoms and further research is needed to investigate whether the same pattern of results would be seen with individuals with a range of severity of depressive symptoms. A larger range including those with more severe depressive symptoms, would allow for the examination of the extent of perceiver sensitivity. With a wider range of symptoms the relationship between depression, rumination

and any interactions that exist in regards to emotion sensitivity could be more fully investigated.

Rumination associated with depressive symptoms has been shown to have an effect on emotion recognition, and there is a suggestion that level of rumination also has an effect on the ability to judge affective state. As rumination and depressive symptoms have been shown to be highly correlated, the interactive effect between these two variables is an important factor to consider in emotion sensitivity research. By examining these two factors together, the effect of their relationship can be seen in relation to emotion sensitivity.

1.4 Mechanisms Related to Impairments in Emotion Recognition

It has been suggested by previous research that the underlying impairments related to emotion sensitivity in those with depressive symptoms are an issue of attention. It has been theorised it may be a lack of attention to certain emotional stimuli and a preoccupation with negative feelings, which leads to less attention being paid to certain stimuli in the social environment (Persad & Polivy, 1993). Individuals with depressive symptoms or a diagnosis of depression have also been shown to display what is described as an attentional bias towards negative expressions over other expressions, particularly sadness (e.g. Gotlib et al., 2004). This suggests that the underlying mechanism behind poor emotion sensitivity is selective attention, due to the mood state of the individual. Individuals with depressive symptoms may attend less to positive emotions (such as happiness) and more to negative emotions (such as sadness). This bias is theorised to be related to mood congruency, in which perceivers tend to make judgements which are related to their underlying affective state (Ambady & Gray, 2002). The selective attention

towards negative expressions could be driven by rumination (Raes, Hermans, & Williams, 2006), in that individuals have an internal analytical focus on depressive symptoms and this in turn drives attention when interpreting facial expressions of emotion.

Another suggested mechanism behind impaired processing of facial expressions of emotion, is the information processing strategy of individuals experiencing depressive symptoms. As reviewed by Ambady and Gray (2002) both transient and chronic sadness have been found to be characterised by a deliberative processing strategy. A deliberate processing strategy is characterised by the conscious and intentional processing of information. As a major feature of a depressive disorder is chronic low mood or sadness, this deliberate processing style could also apply to those experiencing depressive symptoms. Ambady and Gray (2002) suggested that in social situations the decoding of non-verbal behaviour (e.g. facial expressions of emotion) by perceivers is better viewed as an automatic process meeting many of the automatic processing criteria: it occurs outside awareness (Dimberg, Thunberg & Elmehed, 2000; LeDoux, 1996; Niedenthal, 1990), and without intention (Dimberg & Thunberg, 1998; Dimberg et al., 2000; Dimberg & Petterson, 2000). It is also theorised that intentional or deliberate processing of social information may in fact be detrimental to the accuracy of social judgements (Ambady & Gray, 2002). Ruminative cognitive style may be associated with this deliberative processing strategy, as individuals are already engaging in an analytical cognitive style in relation to their depressive symptoms. Individuals engaging in high levels of rumination may show similar patterns as those experiencing states of sadness, as rumination has also been associated with deficits in social decision making (Lyubomirsky & Nolen Hoeksema, 1995).

In recognising facial expressions of emotion, a deliberate processing style may reduce the efficiency in which this information is processed. Engaging in a distracting task (i.e. a cognitive load) while completing a social judgement task has been found to improve the accuracy of those with induced sad mood (Ambady & Gray, 2002). This finding appears to reflect that when participants were distracted and possibly more likely to be employing an automatic processing style, their accuracy in making social judgements improved. With regard to participants without depressive symptoms, they have been shown to accurately recognise facial expressions of emotion under a cognitive load, showing only slight differences in accuracy for some emotions without a cognitive load (Tracy & Robins, 2008). Processing style could therefore be a possible mechanism behind the impaired recognition of facial expressions, in those with depressive symptoms and who engage in rumination.

1.5 The Case of Posed and Genuine Emotions

Ekman, Friesen and O'Sullivan (1988) reported that people can at least partially separate their underlying experience of emotion from an outward expression visible to others. This finding indicates that an individual may experience an emotion without outwardly expressing it in a facial expression, or express an emotion without the accompanying emotional experience. Facial expressions being either associated with a congruent emotional experience, or a non- congruent emotional experience forms the basic distinction between genuine and posed expressions of emotions. Terms also used to refer to genuine and posed expressions include felt and unfelt expressions of emotions, and involuntary and voluntary expressions.

Posed and genuine expressions of emotion differ at a neurological level as it has been found that different pathways in the brain are activated when displaying either a genuine or posed expression. The activation of older subcortical neural pathways is involved in the creation of genuine expressions of emotions (Damasio, 1994; Gazzaniga & Smylie 1990). While posed expressions of emotion involve the activation of the more recently developed motor cortex (Damasio, 1994; Gazzaniga & Smylie 1990). These differences have been observed in stroke patients. Patients who have sustained damage in areas associated with older neural pathways show asymmetry in involuntary (genuine) facial expressions, but not in voluntary (posed) expressions; patients with damage to the motor cortex show the opposite pattern (Damasio, 1994). This differential activation is an indication that genuine and posed expressions occur in different contexts, and therefore communicate different information.

Both posed and genuine expressions are important in social perception, providing perceivers with different information for social interaction. While a genuine smile is an expression of happiness or enjoyment, a posed smile can be disguising other feelings or a neutral mood state (Ekman, Friesen, & O'Sullivan, 1988; Gosselin, Warren & Diotte, 2002). Illustrating that while an individual presenting a genuine smile has an underlying emotional state of happiness, this cannot be said for someone presenting a posed smile. The difference between the underlying mood state associated with posed and genuine expressions has consequences for the interaction between the perceiver and the individual displaying these expressions. A person displaying a genuine smile is experiencing happiness and affords differing opportunities for further interaction than a person displaying a posed smile. A genuine smile is an indication that cooperative behaviour may be

engaged in with the individual displaying the expression (Owren & Bachorowski, 2001), a posed smile is not associated with the opportunity for such behaviour. Considering sadness, genuine expressions are associated with feelings of sadness, which may elicit sympathy or comfort from others. While posed expressions of sadness may be an attempt to elicit such sympathy or comfort from others without the experience of sadness. Misinterpretation of facial expressions of emotion can therefore lead to unsuccessful social interactions.

Correctly identifying the affective state of those who we interact with has important implications for who we can trust for a successful interaction. Therefore, reliable visual information specifying the differences between genuine and posed expressions is important for perceivers to be able to interact with others successfully. However, this information needs to be readily perceivable to provide an advantage in social situations.

1.6 Posed and Genuine Expressions of Happiness – The Smile

Firstly it is important to consider posed and genuine expressions of happiness, as the distinction between these expressions has received the most attention in the research in this area. The most commonly studied facial expression of emotion is the smile, which is associated with happiness. French anatomist Duchenne de Boulogne was the first to characterise the genuine smile as containing the contraction of two major muscle areas (Ekman, Davidson, & Friesen, 1990). The first muscle involved in smiles is *zygomaticus major* extending from the top of the cheekbone to the upper lip, which when contracted pulls the corner of the mouth outward and upward. The contraction of *zygomaticus major* is a movement most people are able to complete voluntarily (Ekman, Davidson, & Friesen, 1990). The

second muscle involved in genuine smiles is *orbicularis oculi*, which when contracted pulls the skin towards the eye ball causing wrinkles or ‘crow’s feet’ around the corners of the eyes, this is also referred to as the ‘Duchenne Marker’(Ekman, Davidson, & Friesen, 1990). While most people are able to voluntarily contract the medial portion of *orbicularis oculi*, the ability to contract the lateral portion voluntarily is not a common ability (Ekman, Roper, Hager 1980). It is only the lateral parts of the muscle that are involved in the expression of genuine happiness, as was noted by Duchenne and confirmed by Ekman, Friesen and O’Sullivan (1988). It is the combination of *orbicularis oculi* and *zygomaticus major* contraction that gives the impression of genuine happiness, contraction of *zygomaticus major* alone does not (Ekman, Davidson, & Friesen, 1990). For examples of a posed and genuine smile see Figure 1.

The contraction of the medial portion of *orbicularis oculi* involved in genuine smiles is often regarded as a marker of felt emotion; however, there is some argument in the literature concerning the reliability of this marker. *Orbicularis oculi* contraction has been found to occur in both genuine and posed smiles, or be absent in genuine expressions (see Krumhuber & Manstead, 2009; Schmidt, Ambadar, Cohn, & Reed, 2006; Soussignan, 2002). The contraction of *orbicularis oculi* has also been found to occur in negative emotions such as distress, pain and sadness (Ekman & Friesen, 1982). Contraction of *orbicularis oculi* may be perceived differently when present in expressions of different emotions. The perception of both positive and negative emotions is affected by the presence of *orbicularis oculi* contraction (Bolzani Dinehart, Messinger, Acosta, Cassel, Ambadar & Cohn, 2005; Messinger, 2002). Specifically when *orbicularis oculi* contraction was associated with infants’ smiles, positive expressions were rated as more positive; when it was associated with

crying faces these expressions were rated as more negative. However, despite some inconsistency in the literature, the 'Duchenne Marker' is still maintained as being a reliable marker of the experience of happiness.

Posed and genuine smiles are thought to differ on several features. Ekman & Friesen (1982) postulate five potential markers that differentiate between posed and genuine smiles: 1) The Duchenne marker, characteristic of genuine but not of posed smiles, 2) The symmetry of *zygomaticus major* contraction; genuine smiles possesses more symmetry in the contraction of this muscle than posed smiles (supported by Ekman et al., 1981; Gazzaniga & Smylie, 1999), 3) The smoothness of muscle contraction; genuine smiles are smoother in their contraction of the muscle groups involved than posed smiles, 4) The duration of the expression; genuine smiles have a more standard duration when compared to posed smiles which are more erratic in their duration (supported by Frank, Ekman, & Friesen, 1993; Hess & Kleck, 1990), 5) The degree of synchrony of action; the movements contained in genuine smiles are more in sync than those present in posed smiles.

This indicates that there are several reliable markers available for use by perceivers to differentiate between posed and genuine happiness.

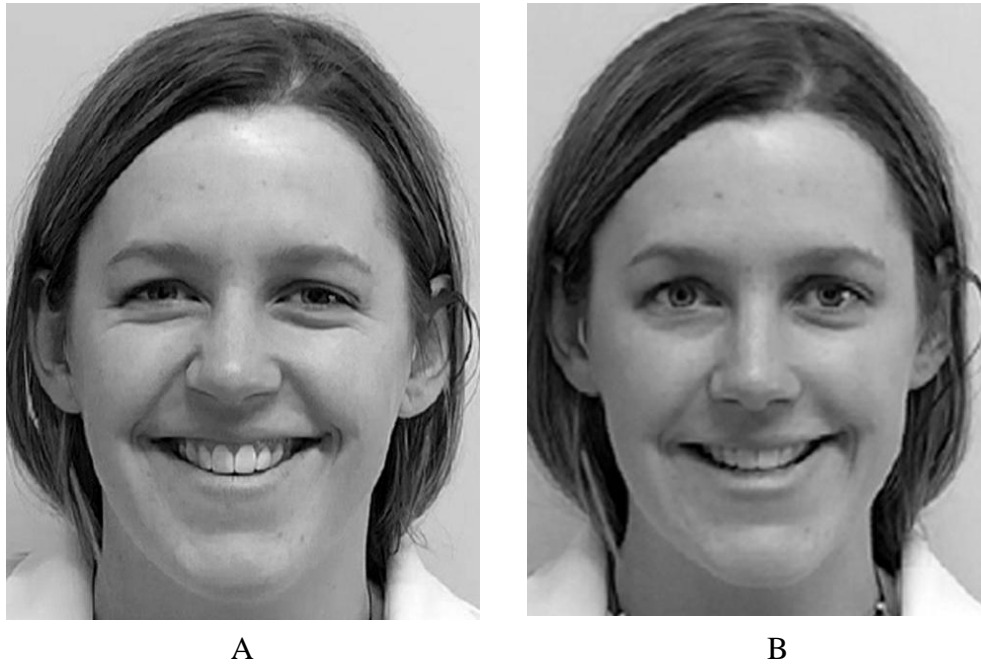


Figure 1. A Genuine (A) and Posed (B) Smile

1.7 Posed and Genuine Expressions of Sadness

With regard to other basic emotions, there is not as much evidence of physiognomic differences between posed and genuine expressions. However, sadness is one emotion that has been investigated and defined in terms of what characterises genuine and posed expressions (McLellan, Johnston, Dalrymple-Alford & Porter, 2010). The contraction of *frontalis pars medialis* and *corrugator/depressor supercilii* (which raise and lower the inner brow respectively) result in the straightening of the inner portion of eyebrow or an oblique angle and a triangulation of the inner upper eye lid. These patterns of muscle movement are often found in prototypical expressions of sadness (e.g. Ekman, 2003; Gosselin, Kirouac & Dore, 1995; Kohler et al., 2004) and have been suggested as the core movements specifying sadness (McLellan et al, 2010). The movements described above are more probable in genuine than posed expressions of sadness (Gosselin et al., 1995).

All expressions of sadness typically contain contraction of at least two of the following muscles - *frontalis pars medialis* (raises the inner brow), *corrugator supercillii* (lowers the brow), *depressor anguli oris* (lowers the corner of the lips), *mentalis* (raises the chin) (Gosselin & Kirouac, 1995; Kohler et al., 2004). However, it is the simultaneous contraction of the *frontalis* and *corrugator/depressor supercillii* that is only present in genuine expressions of sadness (McLellan et al., 2010). Posed expressions of sadness have also been found to be more exaggerated than genuine expressions (Naab & Russell, 2007; Tcherkassof, et al. 2007), containing additional as well as more intense muscle movements. For examples of a posed and genuine expression of sadness see Figure 2

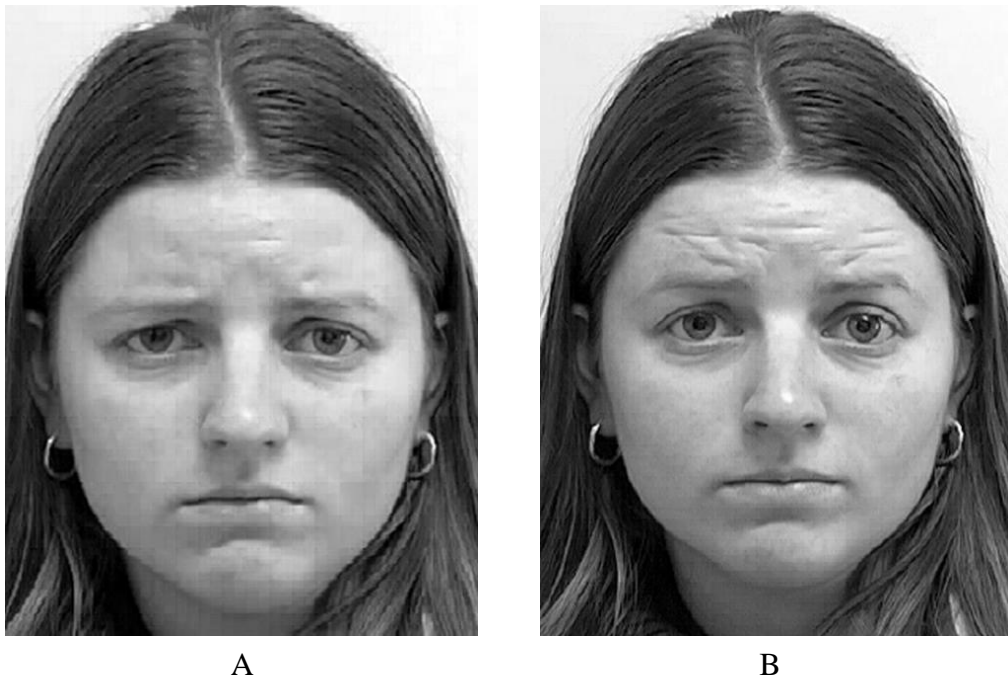


Figure 2. A Genuine (A) and Posed (B) Expression of sadness

1.8 Perceiver Sensitivity to the Differences Distinguishing Posed and Genuine Emotions

Facial expressions as a source of information are only valuable if the information presented can be reliably detected by perceivers. While research has shown that perceivers are sensitive to emotional information present in prototypical displays of emotions, how sensitive are perceivers to the information specifying posed versus genuine emotions? Healthy adults have been shown to be sensitive to the differences between posed and genuine smiles (Frank, Ekman, & Friesen, 1993; McLellan et al., 2010; Miles & Johnston, 2007). Participants in such studies have shown the ability to judge the emotional state of happiness from photographs of smiles, both when asked if targets were displaying happiness and when asked if the targets were actually feeling happy. Perceivers show more sensitivity to the emotional experience of happiness from smiles when asked if targets were experiencing happiness than when asked if targets were only showing happiness (McLellan et al., 2010; Miles & Johnston, 2007). This demonstrated that when explicitly asked to attend to affective state, participants are sensitive to information specifying felt emotion. The ability to differentiate between posed and genuine expressions has been shown to be similar for both photographs and video displays of expressions (Miles & Johnston, 2007). While dynamic displays of expressions potentially provide more information specifying whether a smile is genuine or posed, these displays have not shown significantly improved sensitivity over static displays. Healthy adults have also been shown to be sensitive to differences between genuine and posed expressions of sadness, using similar methods as for happiness (McLellan et al., 2010). Although the levels of sensitivity for expression of sadness were lower than for those found for expressions of happiness. Other studies have also shown that

perceivers are less sensitive to sadness specified in facial expressions compared to happiness (Calder et al, 2003; Gosselin et al., 1995).

Previous research has often involved perceivers making explicit judgements about the nature of facial expressions; these explicit judgements while providing information regarding perceiver sensitivity may not reflect behaviour in real world social interactions. Previous research has shown that the exposure to facial expressions, without explicit labelling can have an effect on perceiver behaviour. Genuine smiles have shown a priming affect for positive words versus negative words (McLellan et al., 2010; Miles & Johnston, 2007). Genuine smiles have also shown an effect on product preference in perceivers. When evaluating emotionally neutral products worn by a model (t-shirts identical in style but displayed in different colours), perceivers showed a preference for t-shirts paired with the model displaying a genuine smile over posed smile or a neutral expression (Peace, Miles & Johnston, 2006). These findings indicate that even when not asked to explicitly attend to facial expressions of emotion, these expressions showed an effect on perceiver behaviour.

Whether the facial expressions of others are perceived as posed or genuine has been shown to have an effect on the behaviour of the perceiver as discussed above. Indicating that ability to perceive the differences between posed and genuine emotions has consequences for social behaviour, and consequently impact the success of social interactions. The focus of more recent research involving posed and genuine expressions has been on populations that have shown deficits in the processing of facial expressions and that also experience social difficulties. Populations of concern have included those with Autistic Spectrum Disorder (Blampied, Johnston, Miles, & Liberty, 2010; Boraston, Corden, Miles, Skuse & Blakemore, 2008) and Alzheimer's disease (McLellan et al., 2010). These two

groups have been shown to have impaired abilities in differentiating posed and genuine expressions when compared to controls. The ability of those with depressive symptoms to differentiate between posed and genuine expressions warrants consideration, as other populations with social difficulties have been found to have impairments in this area.

1.9 Summary of the Current Research

Previous research has shown that individuals with depressive symptoms show difficulty recognising lower intensity positive emotions in facial expressions (Joormann & Gotlib, 2006; Surguladze et al., 2004) and are more biased towards identifying negative emotions (Gur et al., 1992; Hale, 1998). Rumination associated with depressive symptoms has also been shown to have an effect on the perception of negative emotions (Raes, Hermans, & Williams, 2006). However, there has been little research focused on the sensitivity of individuals with depressive symptoms who engage in rumination to the cues specifying genuine and posed expressions of emotion, which the current research aimed to address. Rumination has been theorised to be driving the biases of attention which lead to emotion recognition in impairments in those diagnosed with depression (Raes, Hermans, & Williams, 2006). Previous research has also found that the effects of rumination on sensitivity to affective state are related to depressive symptoms (Johnston, Carter & McLellan, in press). This suggests a need for the relationship between symptoms of depression and level of rumination to be investigated further in relation to emotion sensitivity especially considering that depression and rumination scores have been shown to be highly correlated. Relationships found with either depressive symptoms or level of rumination and emotion sensitivity need to take into consideration how these

variables may be showing combined effects and this will be considered in the current research.

The current research had a focus on happy, sad and neutral facial expressions, as previous research has shown that individuals with depressive symptoms have specific difficulties concerning these particular expressions (e.g. Gur et. al, 1992). These expressions of emotion also have the most reliable markers distinguishing posed and genuine expressions when compared with other basic emotions.

Building and extending on the previous research concerning emotion recognition and its relation to depression and rumination, the current research investigated the sensitivity of those with a range of depressive symptoms (as measured by the Depression subscale of the Depression, Anxiety and Stress Scales - DASS; Lovibond & Lovibond, 1995) and level of rumination (as measured by the Rumination subscale of Response Styles Questionnaire - RSQ-R; Nolen- Hoeksema, 1991) to the distinctions between posed and genuine facial expressions of emotion.

The current research also investigated the mechanisms underlying impairments in emotion recognition suggested in the literature, and how they are linked with depressive symptoms and rumination. One mechanism suggested being an attentional bias towards negative expressions (e.g. Gotlib et al., 2004). The current research investigated the relationship between attention and ability to differentiate between posed and genuine expressions by employing a recognition task (measuring recognition of displays from the experimental task) as a proxy measure for attention. In addition, related to the previous findings of processing effects on judgements of non-verbal social behaviour (Ambady & Gray 2002; Tracey and Robins, 2008), the current research investigated the effect of distraction (cognitive

load) on perceiver sensitivity, and how it related to depressive symptoms and rumination.

To investigate emotion sensitivity participants completed an emotion categorisation task modified from Johnston, Carter & McLellan (in press). The task involved participants first viewing blocks of photographs and indicating whether targets were showing the specified emotion (happiness or sadness). Secondly participants were asked to indicate whether targets were feeling the specified emotion. This allowed differences in perceiver sensitivity when asked to explicitly attend to affective state to be seen. In order to examine the effect of distraction on information processing and its relationship with perceiver sensitivity, participants completed the emotion categorisation task while under a cognitive load (remembering a seven digit number) and without a cognitive load.

To investigate whether an attentional bias was present and how this was related to perceiver sensitivity, participants completed a recognition exercise at the completion of the emotion categorisation task as a proxy measure for attention paid to targets in the task. Participants were shown a series of photographs, half of which were present in the emotion categorisation task and half of which were entirely new photographs. Participants were asked to identify which of the targets had been present in the emotion categorisation task.

Previous research investigating emotion recognition in both those experiencing depression and engaging in rumination allowed for predictions to be made about how participants will perform in the current research. Based on previous findings in the literature outlined in the introduction the following predictions were made in the current research:

Due to the strong relationship present between depression and rumination it would be expected that these two variables would show interaction effects with regards to the predictions outlined below. It was predicted that both level of depressive symptoms and levels of rumination would show negative correlations with emotion sensitivity in conditions without a cognitive load component. It was expected that the higher the level of depressive symptoms and level of rumination, the lower the sensitivity to the differences between posed and genuine expressions of emotion.

Given the theory that deliberative processing has a detrimental effect on judgements concerning non-verbal behaviour (Ambady & Gray), it was predicted that when completing the task under cognitive load higher levels of depressive symptoms and level of rumination would be associated with increased sensitivity compared to conditions without a cognitive load. This relationship was predicted because experiencing a cognitive load was expected to distract from deliberative processing of the facial displays.

Considering bias, it was predicted that both level of depressive symptoms and level of rumination would show positive correlations with bias to expressions of sadness. It was expected that higher levels of depressive symptoms and rumination would be associated with higher levels of bias to sad expressions.

With regard to the recognition task, it was predicted that both level of depressive symptoms and level of rumination would show negative correlations with recognition of expressions of happiness and positive correlations with recognition of expressions of sadness. It was expected that higher levels of depressive symptoms and rumination would be associated with lower recognition of expressions of happiness; higher levels of depressive symptoms and/or rumination would be

associated with greater recognition of sad expressions. Attention paid to those expressions in the emotion categorisation task was to be inferred from these relationships.

2. METHOD

2.1 Participants

Participants were 101 Canterbury University students and members of the wider Christchurch community who voluntarily participated in the study. Participants were recruited through the use of posters advertising the study (see Appendix A), which were placed on notice boards throughout the University, local supermarkets and public libraries. Participants were also recruited through the University's Psychology Department Undergraduate Participant Pool website. The Participant Pool consists of students enrolled in Psychology Undergraduate papers PSYC 105 and 106; a requirement of these papers is that students participate in a research study of their choice and complete an accompanying question and answer sheet addressing the research principles of the study in order to gain 1-2% course credit.

Inclusion criteria were applied. To be included in the study each participant had to report having normal or corrected-to normal vision (the data from one participant who was legally blind was omitted from the reported analyses) and speaking English fluently at home or at work. Participants also had to report having no previous history of brain injury or any significant past or current psychiatric condition requiring the intervention of a health professional (other than symptoms of depression and anxiety).

The final sample included in the data analysis was 100 participants (female =66), ranging in age from 17 – 71 ($M = 22.8$, $SD = 8.8$), and having on average 14.9 years of education ($SD = 2.1$). The reported ethnicities of participants was as follows: 62 NZ European, 12 Other European, 8 Asian, 6 NZ European/Maori, 2 NZ

European/Asian, 2 American, 2 African , 2 Australian, 1 Maori, 1 Samoan, 1 Canadian and 1 Scottish/Malaysian.

After completing the study participants received a \$10 voucher to thank them for their time. Those who were recruited through the Psychology Department Undergraduate participant pool (n = 60) received course credit (between 1-2%) instead of a voucher, on completion of the question and answer sheet.

2.2 Materials and Measures

2.2.1 Depression Anxiety and Stress Scales (DASS; Lovibond & Lovibond, 1995)

The Depression Anxiety and Stress Scales (DASS) were used to measure each participant's level of depression and anxiety. The DASS is a relatively quick paper and pen questionnaire that was completed in about 5 minutes by most participants. The DASS is based on a dimensional rather than a categorical conceptualisation of psychological disorder and as such does not allocate those who complete the measure to discrete diagnostic categories. The DASS does however have suggested categorical distinctions with suggested cut off scores for normal, mild, moderate, severe and extremely severe categories for each subscale. The DASS contains 42 items and each participant responded to the extent that each item applied to them over the preceding week (0- "Did not apply to me at all"; 1- "Applied to me to some degree, or some of the time"; 2- "Applied to me a considerable degree, or a good part of the time"; 3 – "Applied to me very much, or most of the time"). The measure is broken down in three sub-scales (Depression, Anxiety, and Stress) each containing 14 items, and having a possible range of 0-42. Higher scores in a particular sub-scale indicate higher levels of that factor, for example higher scores in the Depression scale indicate increased depression severity. Depression scores were

the main focus for analyses and Anxiety scores were analysed in order to assess the level of these symptoms in participants, and be aware of any effects of anxiety. Given the focus of the present research the Stress sub-scale score was not included in any of the analyses.

The DASS has been shown to have good test re-test reliability with alpha values of 0.91, 0.81, and 0.89 for the Depression, Anxiety, and Stress scales respectively (Lovibond & Lovibond, 1995). The DASS factor structure has been supported by both exploratory and confirmatory factor analysis (Lovibond & Lovibond, 1995). The DASS Anxiety scale and the Beck Anxiety Inventory (BAI) show a high correlation (0.81) and the DASS Depression scale and the Beck Depression Inventory (BDI) are also highly correlated (0.74) (Lovibond & Lovibond, 1995). Lovibond and Lovibond (1995) suggest the lower correlation between the BDI and the DASS Depression scale may result from the BDI containing more items related to the somatic complaints of depression.

2.2.2 Ruminative subscale of Response Styles Questionnaire (RSQ-R; Nolen-Hoeksema, 1991)

The modified version of the Ruminative subscale of the Responses Styles Questionnaire (RSQ-R) was used in this study to measure the level of each participant's rumination (Treynor, Gonzalez & Nolen-Hoeksema, 2003). The RSQ-R contains 25 items and is a brief paper and pen questionnaire that can be completed in about 5 minutes by most participants. The RSQ-R is a self-report scale assessing the extent of rumination in situations of low mood or depression. For each item (e.g. I analyse recent events to try and understand why I am depressed) each participant is asked to indicate whether they never, sometimes, often or always think or do this

when they feel depressed. Responses are converted to a 4-point scale and scores are summed to give a range from 25-100. Higher scores are an indication of greater rumination. The RSQ-R has been shown to have both high reliability and validity in both clinical and non clinical samples (Bagby et al., 2004, Nolen-Hoeksema, 1991). Bagby et al., (2004) reviewed the stability of the RSQ-R across studies and found r values ranging from 0.36 – 0.80.

2.2.3 Facial Displays

Facial displays were used in the Emotion Categorisation Task and the Recognition Task. The facial displays used were generated in previous research studies in the Social Perception Laboratories in the Psychology Department of the University of Canterbury, and a summary of the generation process follows. Full details can be found in McLellan (2008).

In the generation phase participants were seated approximately 60cm in front of a computer monitor where stimulus material was presented in a PowerPoint slideshow. Each participant was recorded using a digital video camera mounted above the monitor. The slide show included pictures from the International Affective Pictures System (IAPS; Lang, Bradley, & Cuthbert, 2001) and sound clips from the International Affective Digitized Sounds database (IADS; Bradley & Lang, 1999), which were used to elicit affective responses. To generate neutral expressions, participants were asked to look into the camera and relax. To generate posed expressions, participants were asked to smile as if they would for an ID photo, or recreate how they thought they might have looked earlier when they experienced sadness.

The expressions used in the present study were coded using the Facial Action Coding System (FACS) (Ekman, Friesen & Hager, 2002). The FACS is widely used to describe and measure facial behaviour, and is based on how the contraction of different facial muscles affects the appearance of the face. Action Units (AUs) are used to describe movement in the face, and combinations of AUs are used to describe expressions of prototypical facial expressions of emotion. The genuine expressions of happiness used in the present study involved both activation of *zygomaticus major* (AU12; raises the corner of the lip) and *obicularis oculi* (AU6; creates wrinkles in the outer corner of the eye), while posed expressions only involved activation of *zygomaticus major* (AU12). Both types of expression included the contraction of *depressor labii inferioris* (AU25) or *masseter* (AU26), to ensure the display of teeth. Both types of sad expressions included contraction of at least two of the following AUs found to most commonly occur in sad expressions (as identified in Gosselin & Kirouac, 1995; Kohler et al., 2004;) – *frontalis pars medialis* (AU1; inner brow raiser), *corrugator superciii* (AU4; brow lowerer), *depressor anguli oris* (AU15; lip corner depressor), *mentalis* (AU17; chin raiser). Genuine but not posed expressions of sadness contained simultaneous contraction of AU1 and AU4. All of the posed and genuine expressions were matched for intensity level (± 1 level), according to FACS criteria. During the generation procedure each participant was asked to rate their reaction to each stimulus display, by a forced choice option (happy, sad, fear, surprise, angry, disgust, and neutral). They also recorded the strength of their reactions using a low/moderate/high visual scale. Each of the genuine expressions used in this study was elicited by an appropriate stimulus during a self-reported moderate to high experience of the relevant emotion and was FACS coded as corresponding to prototypical movements associated with each emotion. Each of the

posed expressions also corresponded to prototypical movements associated with each emotion but in contrast were not elicited during the self-reported experience of any emotion. The neutral expressions were generated when the participants reported a neutral state and there was no discernible movement of facial muscles. The present study used black and white facial displays that were cropped to present head and shoulders only and were standardised for size.

2.2.4 Emotion Categorisation Task

The Emotion Categorisation task is a modified version to that used in Johnston, Carter and McLellan (in press). There were eight blocks of trials in total in the Emotion Categorisation Task, with each block comprising of 21 facial displays (7 sets of posed, genuine and neutral expressions). Participants were asked to judge two emotions: happiness and sadness, and there were two conditions within each emotion: show and feel. The same blocks were also completed under cognitive load.

The facial displays were first presented in the show conditions, then the feel conditions with the order of emotion counterbalanced and order of the displays within the blocks randomised for each participant. Participants completed four blocks of trials for each target emotion; one trial judging the emotion shown and one judging the emotion felt, and then making these same judgements while under cognitive load. Participants made their judgements by pressing the A (for YES the person is Feeling/Showing the target emotion) and L (for NO the person is Not Feeling/Showing the target emotion) keys on a laptop keyboard.

The cognitive load manipulation was a modification to the task, and the order that participants completed the cognitive load condition was counterbalanced. To manipulate cognitive load a seven digit number appeared on screen before each

block of trials (each of the four blocks was assigned its own number) and the participant was asked to repeat it out loud twice in order to assist with recall at the end of the block and to ensure they read the number correctly (similar task used in Tracy and Robins, 2008). That each participant experienced cognitive load was verified by the attempt to recall the seven digit number at the end of each block of trials. Correct recall of the number was not required, as it has been shown that results in cognitive load conditions do not differ across participants who correctly recall numbers and those who do not (Tracy & Robins, 2008).

All instructions for the Emotion Categorisation task were provided on an instruction sheet (see Appendix B) that participants read before completing the task, and instructions were also explained verbally and provided on the computer screen. It was explained that the expression and experience of emotion are not always the same, and while sometimes an individual can experience an emotion while not expressing it, the opposite is also true. Participants were also informed of the cognitive load condition and told that in some trials they would be asked to remember a number during the task and recall it at the end of the trial.

2.2.5 Recognition Task

The recognition task was a proxy measure for attention paid to faces in the emotion categorisation task; as such participants were not given any indication that a memory task would be included. Participants were presented with a set of facial displays, half being faces from the emotion categorisation task and half being new facial displays (48 displays in total). The new facial displays included the same number of genuine, posed and neutral expressions. Instructions were given to participants that they were going to see a series of photos and it was their task to

determine which of these were present in the previous tasks (familiar photos) and which were not (unfamiliar photos). Participants made their judgements by pressing the A (for YES the person is FAMILIAR) or L (for NO the person is NOT FAMILIAR) keys on a laptop keyboard. Instructions for the Recognition task were presented on screen before the task began and were also explained verbally.

2.3 Procedure

Each participant was tested individually by a female experimenter. Once each participant arrived in the Social Perception Lab s/he was given an Information Sheet to read (see Appendix C), which was then further explained verbally by the experimenter. Each participant was informed that the research was looking at the relationship between responses on questionnaires asking about feelings about self, response to life events and performance on a computer-based task assessing ability to make judgements about emotions in others. After being given the opportunity to ask any questions each participant signed the Consent Form (see Appendix D).

Each participant then completed the Participant Questionnaire Booklet, which contained demographic questions as well as the DASS and the RSQ-R (see Appendix E). The order in which participants completed the DASS and the RSQ-R was counterbalanced. Once the questionnaires were completed each participant was given an instruction sheet for the Emotion Categorisation task and these instructions were clarified verbally.

Each participant was seated comfortably in front of a 14inch laptop and instructed to begin the computer tasks. Instructions appeared on screen before each stage of the task and each block began with a practise trial. Each participant completed four blocks of trials with/without the cognitive load (depending on the

counterbalanced order), and then was given the instructions to complete the next four blocks of trials with/without the cognitive load. After each participant completed the Emotion Categorisation task s/he was given instructions for the Recognition task that s/he then completed.

During the tasks, the experimenter remained in the room to answer any questions and to ensure that each participant carried out the cognitive load condition (read the number aloud twice and recalled the number after each block). The experimenter also reminded each participant of changes to the target emotion and/or judgement condition. After completing the task each participant was debriefed (see Appendix F) and thanked for their participation. The whole procedure was completed in 30 - 40 minutes.

The study was reviewed and approved by the Upper South B Regional Ethics Committee; ethics reference number URB/10/04/016.

3. RESULTS

3.1 Demographic Characteristics of Participants

The demographic details of the 100 participants included in final analyses are presented in Table 1.

Table 1. Demographic Characteristics of Participants

	Mean	SD	Range
Age	22.8	8.8	17 – 71
Reported Education (Years)	14.9	2.1	10-23
Sex (% female)	66%	-	-
DASS-Depression subscale	6.6	8.5	0 – 42
Rumination	52.8	13.8	25 - 86

3.2 Questionnaires

Both the DASS and the RSQ-R questionnaires possessed high reliability with alpha values of .95 and .94 respectively. Shapiro-Wilkes W tests revealed a normal distribution of RSQ-R scores ($W=.974, p=.46$) but a negative skew for the Depression subscale of the DASS ($W=.736, p<.001$). The percentages of participants scoring in each category of the DASS-D were as follows: Normal – 79%, Mild – 6%, Moderate – 7%, Severe – 4%, Extremely Severe - 4%. The DASS-D subscale and RSQ-R showed a significant positive correlation ($r(100) = 0.65, p<.05$).

3.3 Recall in Cognitive Load Trials

Participant data was included in analyses if they attempted to recall the seven digits number. Correct recall was defined as recalling all seven digits of the number (in any order) presented before each of the four cognitive load trials. The percentage of participants that had correct recall in all four trials was 52%, 30% had correct recall

in three trials, 12% recalled the number in only two trials, 5% correctly recalled the number once, and 1% did not recall the number correctly in any trials. There were no significant correlations between number of errors in recall and DASS-D or RSQ-R scores.

3.4 Emotion categorisation

The percentage YES responses for each participant were calculated for each emotion (Happy/Sad), condition (Show/Feel), and expression type (Genuine/Posed/Neutral). The percentages were calculated separately for the no cognitive load condition (see Table 2), and the cognitive load condition (see Table 3). If participants differentiated between posed and genuine expressions, findings would show genuine expressions identified as both showing and feeling the target emotion, but posed expressions identified as only showing the target emotions. Neutral expressions would be expected to be identified as neither showing nor feeling the target emotions. Visual inspection of the data suggests this is the case for each emotion, as the percentage of YES responses for posed expressions is less in the feel condition than in the show condition for each emotion, but there appears little difference in the percentage of YES responses to genuine expressions in the show and feel conditions. If cognitive load is showing an effect on participant categorisation we would expect to see significant differences between the load and no load conditions. There appears to be little difference between the patterns of percentage YES responses across cognitive load conditions. There were also a relatively high number of YES responses to neutral expressions in the sad conditions compared to the happy conditions.

In order to confirm these initial observations, an analysis of variance (ANOVA) was conducted on the data. As sensitivity was the main focus of the current research these analyses can be found in Appendix G.

Table 2. Percentage of YES Responses in the No Cognitive Load Condition by Judgement Condition and Expression Type for each Emotion

Facial Expression		Judgement condition	
		Show (% Yes)	Feel (% Yes)
Happy	Genuine	95	94
	Posed	91	51
	Neutral	7	9
Sad	Genuine	84	76
	Posed	72	43
	Neutral	31	35

Table 3. Percentage of YES Responses in the Cognitive Load Condition by Judgement Condition and Expression Type for each Emotion

Facial Expression		Judgement condition	
		Show (% Yes)	Feel (% Yes)
Happy	Genuine	96	93
	Posed	82	57
	Neutral	7	9
Sad	Genuine	84	74
	Posed	69	40
	Neutral	32	35

3.5 Sensitivity

Responses in the emotion categorization task were also analysed using a non-parametric signal detection analysis. Signal detection analysis is used to determine perceiver sensitivity to information that specifies the target stimuli among information that does not. Sensitivity is calculated by determining hits (when a target is correctly identified) and false alarms (when non target stimuli are incorrectly

identified as being target stimuli). Two analyses were conducted using sensitivity scores, the first included all expression types to look at sensitivity to emotion specified in facial expressions; being the ability of perceivers to distinguish information in facial expressions that specifies affective state from information that does not. Specifically, the first analysis looked at whether participants correctly identified that genuine expressions specified a congruent underlying emotional state, whereas neutral and posed expressions did not. In the second analysis neutral expressions were removed to examine sensitivity to the differences between posed and genuine expressions. Sensitivity in the second analysis referred to the ability to detect information that specifies affective state from information that is representative of affect state but does not specify it. Specifically, the second analysis looked at whether participants identified genuine but not posed expressions as specifying a congruent underlying emotional state.

Participant data was collated into hits and false alarms separately for each emotion, judgment condition, expression type and load condition. A hit was defined as responding YES to a genuine expression in both analyses, while a false alarm in the first analysis was defined as responding YES to either a neutral or a posed expression and in the second analysis a false alarm was defined as responding YES to a posed expression.

The correction recommended by Snodgrass and Corwin (1988) was applied to hits and false alarm rates, in order to convert to the associated rates of hits and false alarms. The corrected rates were used to calculate measures of sensitivity (A') for each participant as a function of emotion, judgment condition and load condition.

The formulas used for the calculation of sensitivity can be found in Appendix H.

Higher scores of A' are indicative of higher sensitivity, the estimates of A' are shown in Table 3

Table 3. Mean Estimates of A' by Emotion and Load condition for each Condition.

Facial Expression		Analysis 1		Analysis 2	
		Judgement condition		Judgement condition	
		Show	Feel	Show	Feel
		A' (SD)	A' (SD)	A' (SD)	A' (SD)
Happy	No Load	0.81 (.12)	0.87(.07)	0.55 (.15)	0.76 (.15)
	Load	0.83 (.08)	0.87 (.22)	0.60 (.16)	0.75 (.21)
Sad	No Load	0.73 (.13)	0.73 (.17)	0.59 (.16)	0.70 (.18)
	Load	0.73 (.12)	0.75 (.14)	0.60 (.18)	0.72 (.17)

Note. Analysis 1 included posed, genuine and neutral expressions.

Note. Analysis 2 included only posed and genuine expressions.

As discussed, in the first analysis, sensitivity refers to the ability to detect information specifying affective state. Higher sensitivity scores indicate greater discrimination of genuine expressions that specify experienced emotion from expressions that do not (posed and neutral expressions). Sensitivity scores ranged from .73 to .87. Single-sample t-tests ($p < .05$) showed that the sensitivity scores were significantly greater than chance (0.5), in each experimental condition, indicating that participants were indeed sensitive to information specifying the differences between experienced and not experienced emotion.

In the second analysis, sensitivity refers to the ability to differentiate between posed and genuine expressions. Sensitivity scores in this analysis ranged from .55 – .76. Single-sample t-tests ($p < .05$) showed that the sensitivity scores were significantly greater than chance (0.5), indicating that participants were sensitive to the differences between posed and genuine expressions of happiness and sadness.

ANOVA was used to confirm these observations. Preliminary analysis showed that there was no effect of sex on sensitivity and this factor was not considered further. Separate 2 (Cognitive load: load/no load) x 2 (Emotion: happy/sad) x 2 (Judgement condition: show/feel) repeated measures ANOVAs were conducted for each sensitivity analysis. Analysis 1 revealed main effects of Emotion $F(1, 99) = 77.51$, $p < .001$, $\eta^2_p = .439$ and Condition $F(1, 99) = 4.79$, $p < .05$, $\eta^2_p = .046$ these were qualified by a significant 3 way interaction $F(1, 99) = 5.26$, $p < .001$, $\eta^2_p = .050$.

In light of the revealed 3 way interactions separate 2 (Cognitive Load: no load/load) x 2 (Condition: show/feel) repeated measures ANOVAs were conducted for each emotion. For happiness, the analysis displayed a main effect of Condition $F(1, 99) = 4.68$, $p < .05$, $\eta^2_p = .045$ qualified by a significant interaction $F(1, 99) = 4.84$, $p < .05$, $\eta^2_p = .047$ which is shown in Figure 3. Post-hoc tests (Tukey, $p < .05$) on the interaction showed that for expressions of happiness in the no load condition participants showed higher levels of sensitivity in the feel condition than in the show condition ($M = .87$ vs. $M = .81$). Participants did not show this difference in sensitivity across conditions when under the effect of cognitive load ($M = .83$ vs. $M = .83$). There was no significant difference between sensitivity in the show condition in no load and load conditions ($M = .81$ vs. $M = .83$). When completing the task without cognitive load participants were more sensitive to information specifying happiness when asked what targets were feeling than when asked what targets were showing. However participants did not show this difference in sensitivity when under a cognitive load. For sadness, the analysis displayed no significant main effects or interactions.

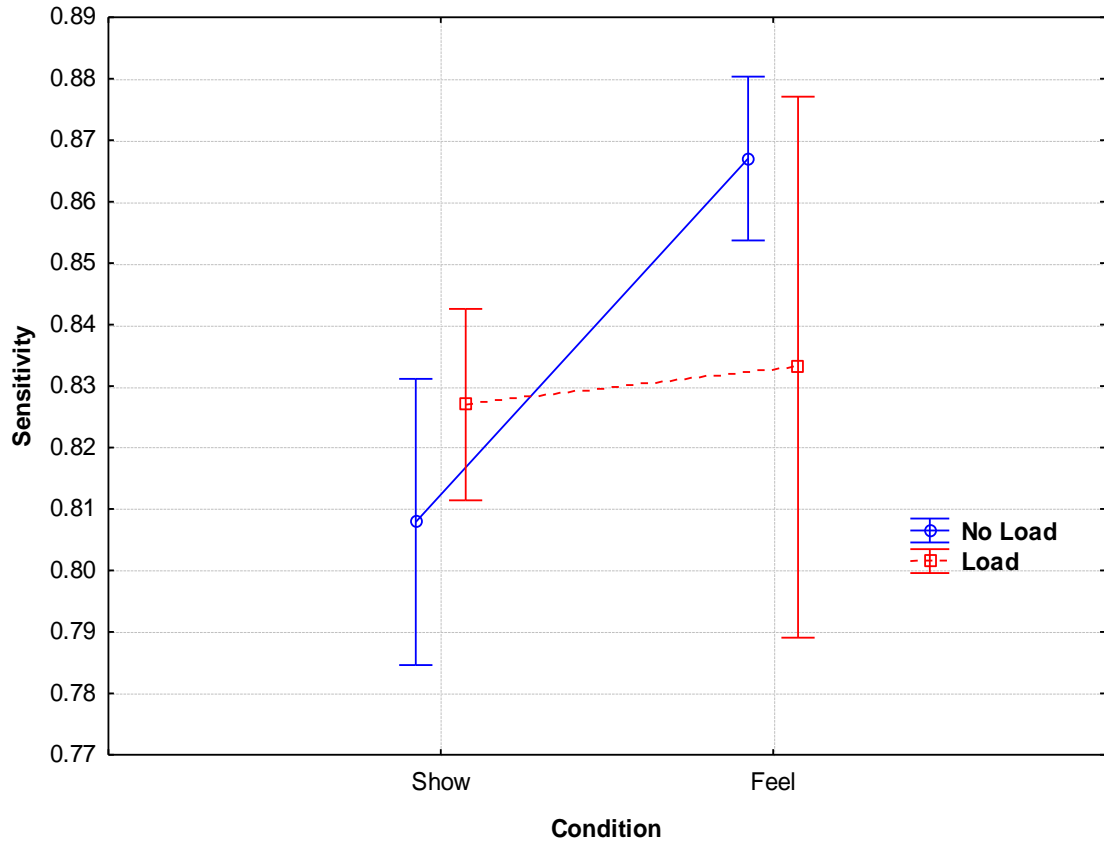


Figure 3. Sensitivity to Happiness in Analysis 1 as a Function of Condition and Load Condition

Analysis 2 revealed a main effect of Condition $F(1, 99) = 93.65, p < .001, \eta_p^2 = .486$ qualified by significant Load by Condition $F(1, 99) = 5.44, p < .05, \eta_p^2 = .052$ and Emotion by Condition $F(1, 99) = 7.01, p < .01, \eta_p^2 = .066$ interactions and a 3 way interaction $F(1, 99) = 6.16, p < .05, \eta_p^2 = .059$.

In light of the revealed 3 way interactions separate 2 (Cognitive Load: no load/load) x 2 (Condition: show/feel) repeated measures ANOVAs were conducted for each emotion. For happiness, analysis displayed a main effect of Condition $F(1, 99) = 84.69, p < .001, \eta_p^2 = .461$ qualified by a significant interaction $F(1, 99) = 11.25, p < .01, \eta_p^2 = .102$, which is shown in Figure 4. Post-hoc tests (Tukey, $p < .05$) on the interaction showed that for expressions of happiness in both the no load and load

conditions participants showed higher levels of sensitivity to the difference between genuine and posed expressions when asked what targets were feeling ($M = .76$ & $.72$) than when asked what targets were showing ($M = .55$ & $.60$). In addition, participants showed higher levels of sensitivity in the show condition when under cognitive load compared to no load, however, there was not a significant difference in sensitivity between load conditions in the feel condition.

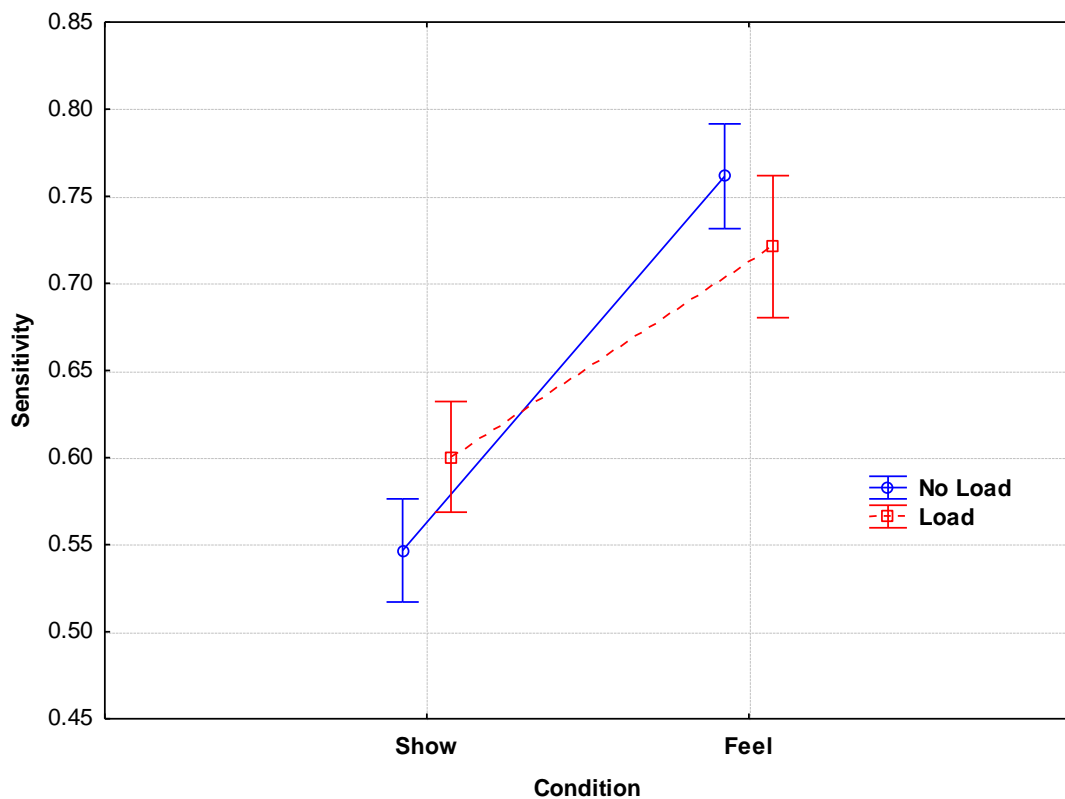


Figure 4. Sensitivity to Happiness in Analysis 2 as a Function of Condition and Load

For sadness, the analysis displayed a main effect of Condition $F(1, 99) = 48.90, p < .001, \eta^2_p = .331$, but no interaction. Post-hoc tests (Tukey, $p < .05$) showed that for expressions of sadness sensitivity to the differences between posed and genuine emotions were significantly higher in the feel ($M = .71$) than the show condition ($M = .59$). Therefore there was no effect of cognitive load found when making judgements about expressions of sadness

3.6 Bias

Response bias was also analysed using a non-parametric signal detection analysis as discussed above and the formulas used for the calculation of response bias can be found in Appendix H. Bias is a measure of the tendency of participants to respond to one response over another, YES or NO in the case of the emotion categorisation task. A negative response bias score indicated the tendency of participants to categorise expressions as showing or feeling the target emotion (answering YES to the question in each judgement condition), over the target not showing or feeling the target emotion. Bias scores were compared to 0 (representing no bias), using single sample t-tests. Bias was shown to be significantly greater than 0 (single sample t test, $p < .05$), except for judgements of sadness in the feel condition in both load conditions in analysis 2. This suggests that participants did not demonstrate a response bias when making judgements differentiating posed and genuine expressions of sadness when asked what targets were feeling but did demonstrate a tendency to respond YES when considering whether targets were showing sadness and when making either judgement with regard to happiness. Bias scores are presented in Table 4.

Table 4. Mean Estimates of B' by Emotion and Load condition for each Condition.

Facial Expression		Analysis 1		Analysis 2	
		Judgement condition		Judgement condition	
		Show $B'' (SD)$	Feel $B'' (SD)$	Show $B'' (SD)$	Feel $B'' (SD)$
Happy	No Load	-0.55 (.22)	-0.31 (.35)	-0.12 (.22)	-0.27 (.29)
	Load	-0.49 (.24)	-0.35 (.35)	-0.16 (.27)	-0.28 (.29)
Sad	No Load	-0.25 (.28)	-0.13 (.35)	-0.09 (.26)	-0.07 (.35)
	Load	-0.26 (.29)	-0.09 (.34)	-0.17 (.24)	-0.04 (.33)

Note. Analysis 1 includes posed, genuine and neutral expressions.

Note. Analysis 2 includes posed and genuine expressions.

Separate 2 (Emotion: happy/sad) x 2 (Judgment condition: show/feel) x 2 (Cognitive Load: no load/load) repeated measures ANOVAs were completed for each analysis. Analysis 1 revealed a main effect Emotion $F(1, 99) = 97.06, p < .001, \eta^2_p = .495$ and Condition $F(1, 99) = 5.12, p < .001, \eta^2_p = .280$. There were no significant interactions. This demonstrated that participants showed higher levels of bias when making judgements about happy expressions compared to making judgements about sad expressions. Participants also showed higher levels of bias when making judgements about what targets were showing compared to making judgements about what participants were feeling.

Analysis 2 revealed a main effect Emotion $F(1, 99) = 19.92, p < .001, \eta^2_p = .167$ which was qualified by a significant Emotion by Condition $F(1, 99) = 3.17, p < .001, \eta^2_p = .249$ interaction shown in Figure 5. Post-hoc tests (Tukey, $p < .05$) showed that levels of response bias were significantly higher for happy expressions than sad expressions in the feel condition ($M = -.29$ vs. $-.06$) but did not differ between emotion in the show condition ($M = -.14$ vs. $-.16$). When asked to judge what targets were feeling, participants showed more bias when making judgements differentiating posed from genuine expressions of happiness than when making the same discriminations for sadness. That is, participants were more likely to indicate the target was feeling happy (regardless of smile type: posed or genuine) but did not demonstrate this tendency for sadness.

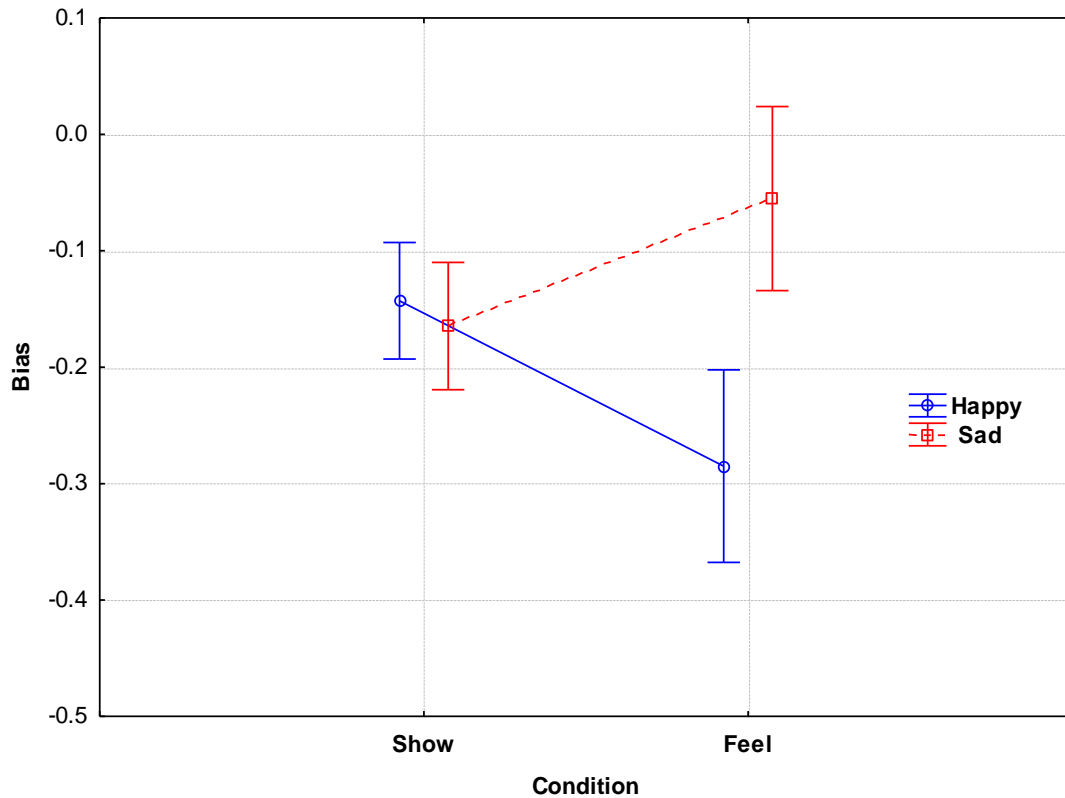


Figure 5. Bias towards Identifying Expressions of Happiness in Analysis 2 as a Function of Emotion and Condition

3.7 Recognition

Percentage of YES responses was not significantly different for familiar faces or unfamiliar faces for each emotion. However, YES responses to familiar faces were significantly higher than to unfamiliar faces. These scores suggest that the participants found the recognition task easy, and since these scores show a ceiling effect, it is difficult to draw any conclusions about attention and its impact.

Percentage YES responses are found in Table 5.

Table 5. Percentage of YES Responses in the Recognition task by each Emotion

Emotion	Familiar Faces (% Yes)	Unfamiliar Faces (% Yes)
Happy	98	0.4
Sad	97	1
Neutral	98	0.5

Recognition scores were also analysed using non-parametric signal detection analysis as discussed above. Participant data was collated into hits and false alarms separately for each emotion. A hit was defined as responding YES to a face that had been present in the emotion categorisation task (a familiar face), while a false alarm was defined as responding YES to face that was not present in the emotion categorisation task (an unfamiliar face). Sensitivity to familiar faces was not significantly different across emotion.

Table 6. Mean Sensitivity and Bias to Familiar Faces in the Recognition task by each Emotion

Emotion	A' (SD)	B'' (SD)
Happy	0.97 (.02)	0.34 (.16)
Sad	0.97 (.02)	0.32(.20)
Neutral	0.97 (.02)	0.32 (.15)

3.8 Relationship between Emotion Sensitivity, Depression, Rumination and Recognition

Pearson product-moment correlations were computed between depression (DASS-D) and rumination (RSQ-R) scores and emotion sensitivity and bias scores. Correlations were also computed between recognition sensitivity and emotion sensitivity and bias scores. The alpha level of $p < .01$ was applied to allow for multiple comparisons being made. Correlations are shown separately for load vs. non load conditions and completed for both analysis 1 (Table 7 & 8) and analysis 2 (Table 9 & 10).

For Analysis 1, in conditions completed without cognitive load a significant correlation was only seen for recognition of sad expressions and sensitivity to expressions of sadness in the feel condition ($r(100) = .29, p < .01$).

Table 7. Correlations between, DASS-Depression, Rumination, Recognition Sensitivity and Emotion Sensitivity and Bias for Conditions without a Cognitive Load for Analysis 1

	<i>A' Show</i>	<i>A' Feel</i>	<i>B'' Show</i>	<i>B'' Feel</i>
Happy				
DASS- Depression	.04	.06	-.15	.06
Rumination	-.03	.13	-.05	-.07
Recognition Happy (A')	.01	.12	-.00	.10
Recognition Sad (A')	-.04	-.04	-.05	-.03
Recognition Neutral (A')	-.03	.13	-.09	-.08
Sad				
DASS-Depression	-.02	-.14	-.04	-.07
Rumination	.04	-.02	-.06	.01
Recognition Happy (A')	.04	.12	-.07	-.06
Recognition Sad (A')	.06	.29*	-.03	-.05
Recognition Neutral (A')	.12	.19	-.06	-.04

Note: Correlations with a * are significant at $p < .01$

Table 8. Correlations between DASS-Depression, Rumination, Recognition Sensitivity and Emotion Sensitivity and Bias for Conditions with a Cognitive load for Analysis 1

	<i>A' Show</i>	<i>A' Feel</i>	<i>B'' Show</i>	<i>B'' Feel</i>
Happy				
DASS- Depression	.05	.08	.20	.06
Rumination	.06	.11	.05	-.07
Recognition Happy (A')	.14	-.07	.12	.10
Recognition Sad (A')	-.03	-.07	.10	-.03
Recognition Neutral (A')	-.08	-.07	.14	-.07
Sad				
DASS-Depression	-.02	-.17	.09	.18
Rumination	.16	-.03	.05	.18
Recognition Happy (A')	.08	.15	-.00	-.05
Recognition Sad (A')	.20	.25	-.13	.02
Recognition Neutral (A')	.11	.09	-.23	-.01

Note: Correlations with a * are significant at $p < .01$

For Analysis 2, for conditions completed under cognitive load a significant correlation was seen between depression scores and sensitivity in the sad feel condition ($r(100) = -.28, p < .01$). Given the high correlation between the Depression and Rumination scores, partial correlations were computed for the significant correlation. When impact of rumination scores were partialled out, the correlation

between depression scores and sensitivity in the sad feel condition was still significant ($r(100) = -.31, p < .05$). There were no significant correlations between depression and rumination scores and recognition sensitivity to any emotions in either analysis.

Table 9. Correlations between DASS-Depression, Rumination, Recognition Sensitivity and Emotion Sensitivity and Bias for Conditions without a Cognitive Load for Analysis 2

	<i>A' Show</i>	<i>A' Feel</i>	<i>B'' Show</i>	<i>B'' Feel</i>
Happy				
DASS- Depression	.06	.06	.05	-.04
Rumination	-.00	.14	.07	-.13
Recognition Happy (<i>A'</i>)	.05	.13	.12	.10
Recognition Sad (<i>A'</i>)	-.05	-.03	-.03	-.04
Recognition Neutral (<i>A'</i>)	-.10	.10	.03	-.00
Sad				
DASS-Depression	-.01	-.15	-.01	-.04
Rumination	.04	.01	-.00	-.04
Recognition Happy (<i>A'</i>)	-.02	-.05	.12	-.04
Recognition Sad (<i>A'</i>)	-.07	.24	.15	-.04
Recognition Neutral (<i>A'</i>)	-.03	.16	-.05	-.00

Note: Correlations with a * are significant at $p < .01$

Table 10. Correlations between DASS-Depression, Rumination, Recognition Sensitivity and Emotion Sensitivity and Bias for Conditions with a Cognitive Load for Analysis 2

	<i>A' Show</i>	<i>A' Feel</i>	<i>B'' Show</i>	<i>B'' Feel</i>
Happy				
DASS- Depression	.08	.12	.03	-.04
Rumination	-.01	.19	-.05	-.13
Recognition Happy (<i>A'</i>)	.07	-.09	-.03	.10
Recognition Sad (<i>A'</i>)	-.06	-.03	.06	-.04
Recognition Neutral (<i>A'</i>)	-.10	-.13	.21	-.12
Sad				
DASS-Depression	-.15	-.28*	.10	.13
Rumination	-.00	-.07	.01	.21
Recognition Happy (<i>A'</i>)	.12	.08	.13	-.01
Recognition Sad (<i>A'</i>)	.08	.13	-.16	-.01
Recognition Neutral (<i>A'</i>)	-.02	.06	-.03	.03

Note: Correlations with a * are significant at $p < .01$

4. DISCUSSION

The current research investigated an area of emotion sensitivity that has been found to be important for successful social interactions. This being the ability to differentiate between facial expressions associated with the experience of emotion and those which are not. The focus of the current research was to investigate sensitivity to emotion specified in facial expressions across a range of depressive symptoms and level of rumination, as both depression and rumination have been associated with social dysfunction and have shown deficits in the recognition of facial expressions of emotion (e.g. Gur et al., 1992; Hale, 1998; Joormann & Gotlib, 2006; Raes, Hermans, & Williams, 2006; Surguladze et al., 2004). The current research also investigated the mechanisms suggested by previous literature to underlie deficits in emotion recognition; the way in which social information is processed (Ambady & Gray, 2002) and selective attention to negative stimuli (e.g. Gotlib et al., 2004). The findings of the current research will be discussed in relation to each of the factors investigated. The implications of research findings, limitations of the current study and directions for future research will also be addressed.

4.1 Relationships between Emotion Sensitivity, Bias, Depression and Rumination scores

Of particular interest to the current research was the relationship between emotion sensitivity, bias and depression and rumination scores. Previous research has typically compared those diagnosed with depression (experiencing severe symptoms) and healthy controls. However, the findings of the current research can be interpreted within the context of previous findings as along a continuum of depression scores the

scores of healthy individuals and those experiencing severe diagnosed depression are included in such a continuum.

It was predicted that both level of depressive symptoms and rumination would be associated with lower sensitivity to differences between posed and genuine emotions and higher levels of bias to expressions of sadness. Because depression and rumination scores were shown to be highly correlated, this was taken into consideration within the relationships found. Depression scores showed a relationship with sensitivity when asked if targets were feeling sadness while participants were under cognitive load. Higher depression scores were associated with lower sensitivity to genuine sadness in this condition. This demonstrated that when judging the expressions of sadness, participants with higher levels of depressive symptoms were less sensitive to the information specifying affective state. This finding is consistent with depressed individuals showing deficits in emotion recognition (Persad & Polivy, 1993). This effect was still evident even when rumination was controlled for, indicating that depression was having its own unique effect. However, that this effect was seen under cognitive load is contrary to the prediction of improved sensitivity under distraction. When considering this finding we must also consider that a symptom of depression is the experience of cognitive difficulties such as diminished ability to concentrate (APA, 2000), and that the experience of depression has been shown to affect performance on cognitive tasks (for a review see Delgado & Schillerstrom, 2009). In the study conducted by Ambady and Gray (2002) examining the effect of cognitive load, the sample included participants with induced sad mood and while a major feature of depression, since sad mood was induced by the experimenters perceivers may not have experienced the cognitive symptoms associated with depression. In depression

cognitive deficits may cause difficulty in completing tasks when under increased cognitive demand and in turn have a detrimental effect on the performance of tasks being completed. This effect may only been seen for expressions of sadness, as those experiencing depressive symptoms show preoccupation with these expressions (Gotlib et al., 2004). When distracted, participants experiencing depressive symptoms may be more likely to identify any approximation of sadness as specifying affective state. While depression scores were not correlated with errors in the cognitive distraction task, this could imply that the cognitive load task was successful in distracting participants from the stimuli in the emotion categorisation task.

Rumination was not significantly related to sensitivity or bias as predicted; this was unexpected due to the previous research findings concerning rumination, emotion recognition and social judgements (Johnston, Carter & McLellan, in press; Lyubomirsky & Nolen Hoeksema, 1995; Raes, Hermans, & Williams, 2006). Rumination has previously been seen to have a significant effect on the perception of facial expressions, even when depression scores were controlled for (Raes, Hermans, & Williams, 2006). Rumination has also been associated with a perceptual bias towards negative information (Lyubomirsky & Nolen Hoeksema, 1995). Rumination was also shown to have an effect on sensitivity to affective state specified in expressions of sadness (Johnston, Carter & McLellan, in press). As rumination is a response to depressive symptoms, it was expected that rumination effects would be tied to depressive symptoms. Rumination may have a more evident effect on attention, due to the analytical thinking style associated with it. However, that rumination was not associated with attention in the current research study may be due to the measures of attention used, which are discussed further below.

4.2 Relationship between Recognition Sensitivity and Other Factors

In the recognition task, sensitivity to familiar faces was very high, and there was no difference in recognition across emotions. Across emotions participants showed near perfect rates of recognition of faces from the emotion sensitivity task. Since recognition rates were essentially at a ceiling any relationships found need to be considered carefully.

There was a relationship between recognition of sad expressions and emotion sensitivity when asked if targets were feeling sadness while completing the task without cognitive load; higher recognition of sad expressions being associated with higher sensitivity when asked to make judgements about what targets were feeling. A possible explanation for this finding is that for expressions of sadness, attending more to the facial displays may lead to improved sensitivity. Since expressions of sadness have less defined differences in terms of posed and genuine expressions of emotion (McLellan et al., 2010), more attention paid to these expressions could possibly lead to improved sensitivity to the emotional state of targets.

Recognition sensitivity was not found to be directly related to depression and rumination scores as predicted and specific biases of attention related to these variables were not found. This may be due to the lack of sensitivity of the methods used to measure attention in the current research. However, considering recognition as a measure of attention paid during the emotion categorisation task, higher levels of recognition (and by proxy, attention) of sadness was shown to be related to higher emotion sensitivity, but only for expressions of sadness.

4.3 Emotion Sensitivity

The current research also investigated the sensitivity of perceivers to the differences between facial expressions of emotion (happiness & sadness) that were associated with a congruent emotional experience, and those that were not. Perceivers were shown to be sensitive to information specifying the experience of emotion (genuine expressions) from expressions that did not (posed and neutral expressions) and also sensitive the differences between posed and genuine expressions of emotion. All sensitivity scores found in the current research were greater than chance levels, in line with previous research (Frank et al., 1993; Johnston, Carter & McLellan, in press, Miles & Johnston, 2007; McLellan et al., 2010).

Firstly sensitivity to facial expressions associated with emotional experience (genuine expressions) and expressions which are not (posed and neutral expressions) will be considered. When making judgements without a cognitive load participants showed higher levels of sensitivity to expressions of happiness in the feel condition over the show condition, showing higher sensitivity when explicitly asked to attend to the emotional experience of targets over when asked to attend to the display of emotion, consistent with previous research findings (Johnston, Carter & McLellan, in press, Miles & Johnston, 2007; McLellan et al., 2010). When experiencing cognitive load, sensitivity to expressions of happiness did not differ as a function of what participants were instructed to attend to, indicating that sensitivity was not higher when asked to explicitly attend to emotional state in this case. This finding was contrary to what was predicted, as cognitive load was expected to either improve sensitivity or not have a significant effect on judgements, as has been shown in previous studies (Ambady & Gray, 2002; Tracey & Robins, 2008). Sensitivity to

expressions of sadness showed no effects of condition or load, with participants employing similar criteria across conditions. Participants displayed higher levels of sensitivity to the emotional experience of happiness compared to sadness. This finding of higher levels of sensitivity to expressions of happiness is consistent with previous studies (Calder et al., 2003; Gosselin et al., 1995; Johnston, Carter & McLellan, in press; McLellan et al., 2010). That perceivers were more sensitive to happiness, could be related to these expressions having several distinct markers of felt emotion compared to expressions of sadness which have fewer distinct markers.

When considering sensitivity of perceivers to the differences between posed and genuine expressions, participants showed greater sensitivity to expressions of genuine happiness when asked what participants were feeling over what they were showing, demonstrating again higher sensitivity when explicitly asked to attend to emotional state. This pattern was found in both load conditions. This showed that perceivers are sensitive to the differences between posed and genuine expressions of happiness regardless of distraction, while cognitive load had an effect on the sensitivity to expressions that specify the affective state of happiness over those that do not.

When comparing performance under cognitive load to no load participants showed higher sensitivity to genuine happiness when asked what targets were showing. When asked if targets were actually feeling happy there was no difference in sensitivity across load conditions. For expressions of sadness, participants showed greater sensitivity in the feel condition over the show condition in both load conditions. Indicating that cognitive load only showed an effect on sensitivity to the differences between posed and genuine emotions when asked if targets were showing happiness.

Cognitive load was used as a technique to prevent intentional processing of stimuli by distracting participants from this kind of processing. The effects of performing the task without a cognitive load were in line with previous research as discussed above. These findings indicated that perceivers were sensitive to the information in facial expressions which specify an underlying affective state, and would then be able to use this information in social interactions. However in conditions where the experience of cognitive load showed contrasting effects to performing the task with no load, results were contrary to predicted and not in line with previous research (Ambady & Gray, 2002, Tracey & Robins, 2008). Compared to no load conditions, the main difference when participants were under cognitive load was that higher levels of sensitivity were not seen when making judgements about target faces when specifically asked to attend to affective state. This contrast indicates that the distraction of a cognitive task may actually impair sensitivity to underlying emotional state. Previously when asked to label expressions of emotion, perceivers have been shown to be unaffected by cognitive load (Tracey & Robins, 2008), however this task of labelling emotions may be more familiar to participants than being asked to explicitly identify if expressions are associated with affective state. Social judgements have been shown to be improved by distraction as it prevents deliberate processing of information (Ambady & Gray, 2002). In the current research participants were asked to make explicit judgements about targets, however in social situations judgements are not normally made in an explicit manner (Ambady & Gray, 2002). A possible reason then why cognitive load did not have the predicted effect could be that participants were asked to make judgements that are normally made in an implicit manner explicitly.

4.4 Bias

Participants showed higher levels of response bias towards expressions of happiness than sadness, as has been found previously (Johnston, Carter & McLellan, in press). Participants also showed more conservative judgements when asked what targets were feeling than when asked what targets were showing with bias scores being higher in the latter condition, which was also consistent with previous research (Johnston, Carter & McLellan, in press; McLellan et al., 2010; Miles & Johnston, 2007). This bias indicates that when participants were asked to specifically attend to affective state there is a reduction in responding that expressions display emotion. This reduction indicates more conservative criteria are being employed in making judgements.

In terms of bias scores in differentiating between posed and genuine emotions, participants showed more bias towards expressions of happiness over sadness when asked what targets were feeling, however biases towards expression of happiness and sadness did not differ when asked what participants were showing. When asked to explicitly attend to affective state participants showed more bias towards expressions of happiness, however when asked what targets were expressing, participants did not show more bias towards expressions of happiness than sadness. Hence a higher response bias towards expressions of happiness is only evident when participants were asked to identify genuine expressions of emotion, rather than when asked to complete the simpler task of identifying what emotion is being expressed. Participants then appear to only apply more conservative criteria when asked to specifically attend to affective state.

4.5 Implications

Social dysfunction is an important aspect of the impairments experienced in depression. Impairments in emotion recognition have been associated with social dysfunction (Leppenen & Hietanen, 2001). Research concerning emotion sensitivity and how depressive symptoms are related to impairments in this area allow us to better understand depression as a disorder. The current findings indicate a relationship between cognitive processes and impairments in emotion sensitivity, suggesting further areas warranting investigation. As rumination is a cognitive response to depressive symptoms, this factor is an important one to consider in relation to the cognitive processes in depression and how this relates to emotion sensitivity. These factors have implications for the focus of therapy in those with depression to address social deficits, such as examining cognitive processes and addressing unhelpful response styles such as rumination. Addressing the mechanisms behind social deficits in therapy would allow for those experiencing depressive symptoms to engage in more successful social interactions.

The task in the current study was looking at the ability of perceivers to attend to differences specifying felt and unfelt emotions, rather than identifying what emotions were being displayed as has been the case in previous studies. This is a different aspect of emotion sensitivity that is fundamental to successful social interactions. The difference in what information perceivers are asked to attend to may be why depressive symptoms were associated with a different pattern of impairments in emotion sensitivity in the current research. Also higher bias towards expressions of sadness compared to happiness, which has been typically shown in those with depressive symptoms, may not be displayed as a prominent effect in this task. Instead less discrimination between genuine and posed expressions of sadness

was displayed. This may indicate that when asked to attend to affective state, those experiencing higher levels of depressive symptoms show a tendency to identify any expression related to sadness as experiencing sadness, and not show this tendency for expressions of happiness.

The current research used ecologically relevant stimuli in order to investigate a specific aspect of emotion sensitivity. This allows the effects of depressive symptoms and level of rumination on emotion sensitivity in the social environment to be more clearly examined, by using stimuli which are a closer approximation to those actually experienced in everyday interactions. Using more ecologically relevant stimuli may be useful in uncovering impairments in emotion sensitivity that may not be discovered by using schematic or purely posed expressions. The current research indicated that impairments in being sensitive to affective state may be different to labelling emotional expressions, and in turn indicated areas of focus in treatment as discussed above.

4.6 Limitations of the Current Research and Directions for Future Research

One of the aims of the current research was to include participants with a range of depressive symptoms in order to examine a trend in emotion sensitivity. While a wide range of depression scores was achieved, scores were still negatively skewed to lower levels of depressive symptoms. The number of participants with depression scores in the more severe ranges was in fact similar to Johnston, Carter & McLellan (in press). A greater number of depression scores in the more severe range may have allowed for the effect of depressive symptoms on sensitivity to underlying affective state to be more clearly seen. Many previous studies have focused on group differences between those diagnosed with depression and non depressed controls.

This group design may display the deficits in depression more clearly, as comparisons are being made between two distinct groups in terms of depressive severity. As a depression diagnosis indicates a high level of symptom severity, comparing this high severity to healthy controls could allow a greater contrast to be seen. In the current research the focus was to examine deficits across a range of depressive symptoms rather than group differences; however, it did not include confirmation of a diagnosis of depression in those with more severe depressive symptoms. Future research focused on a sample with a wide range of depression scores including those with a confirmed diagnosis, indicating a high level of symptom severity causing significant impairments in everyday functioning, may better examine trends in emotion sensitivity deficits.

In the current research perceivers were asked to make explicit judgements about the emotional state of targets. While explicit judgements allow conclusions about sensitivity to be drawn, this may not reflect actual behaviour in social interactions (where judgements are more likely to be made outside conscious awareness (Ambady & Gray, 2002)). Future research including a task that examined the influence of sensitivity on behaviour may be used to display the effects of depressive symptoms and rumination. In studies investigating sensitivity to affective state and the effect of subsequent behaviour, tasks which have been used included priming tasks (Miles & Johnston, 2007; McLellan et al., 2010) or investigated the effect of posed versus genuine expressions on product preference (Peace et al., 2006). These tasks do not ask perceivers to label emotions explicitly; instead they are required to make other judgements which emotional displays may affect, this is a closer approximation to what occurs in real world social interactions.

Considering the recognition task, it appears the requirements of the task were too easy and failed to discriminate a trend in regards to depressive symptoms, rumination and did not allow any inferences about attention to be made regarding these variables. Each individual target was viewed by participants a total of four times; this repeated exposure to stimuli may have facilitated the high levels of recognition of faces present in the emotion sensitivity task. If differences in attention are more subtle in nature, a more sensitive measure would be needed to identify the effects of depressive symptoms and rumination on attention. Previously in the literature attention has been measured by presenting stimuli simultaneously and measuring selective attention (e.g. Gotlib et al., 2004). Future research could endeavour to incorporate such tasks in research designs in order to investigate attention and emotion sensitivity. The current research employed a within subjects design, as mentioned above this resulted in participants being exposed to target stimuli multiple times. A between subjects design comparing across load conditions would reduce the number of times participants were exposed to targets. In order to employ such a design a very large number of participants would be needed which was outside the scope of this research.

4.7 Conclusions

The ability to recognise different facial expressions is a critical skill for effective social interaction. Posed and genuine emotions represent an aspect of emotion perception in social interactions that can have an effect on the success of these interactions. Individuals with deficits in this ability may suffer negative outcomes which may result in social dysfunction and ultimately social isolation. The current research findings suggest there is some relationship between depression and

impairments and the ability to differentiate between posed and genuine expressions of emotion, particularly sadness. The associations between rumination and depressive symptoms need further investigation, especially as rumination is associated with cognitive processes. In terms of mechanisms behind emotion sensitivity, cognitive processes are an area for further investigation. Future research in this area could uncover more prominent and relevant effects with the suggested improvements on the current methodology.

Gaining a clearer understanding of emotion sensitivity deficits will lead to a clearer understanding of depression, rumination and avenues of exploration in therapy to address social difficulties. Improving social functioning in individuals experiencing depressive symptoms will aid in improving the quality of life that they experience.

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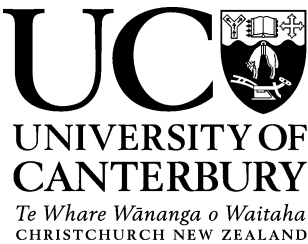
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Facial Expression Study

Would you like to be part of a research project being conducted by researchers at the University of Canterbury? We are looking for people to participate in research looking at recognising emotion in facial expressions.

You will be asked to complete some pen and paper questionnaires and you will also be asked to complete a computer task. Participation takes approximately 20-30 minutes and you will receive a \$10 petrol voucher. For more information and if you are interested in participating please contact the researcher using the details below to arrange an appointment.

Facial Expression Study cla49@ucelive.ac.nz Phone: (03) 3667001 ext. 7190	Facial Expression Study cla49@ucelive.ac.nz Phone: (03) 3667001 ext. 7190	Facial Expression Study cla49@ucelive.ac.nz Phone: (03) 3667001 ext. 7190	Facial Expression Study cla49@ucelive.ac.nz Phone: (03) 3667001 ext. 7190	Facial Expression Study cla49@ucelive.ac.nz Phone: (03) 3667001 ext. 7190	Facial Expression Study cla49@ucelive.ac.nz Phone: (03) 3667001 ext. 7190
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Instruction Sheet

Welcome to the computer tasks. In these tasks we are looking at the ability of people to identify the emotional states of others from looking at their facial expressions.

We are interested whether people can tell whether another person is actually FEELING the emotion that they are SHOWING on their face. This is based on the idea that sometimes we can SHOW (or display) an emotion without actually FEELING (or experiencing) it, while other times we can FEEL (or experience) an emotion without actually SHOWING (or displaying) it.

For example, sometimes if you meet someone you don't particularly like you might still smile politely. In this situation you would be trying to SHOW (or display) happiness (by smiling) even though you weren't actually FEELING (or experiencing) happy.

In these tasks photographs of people will appear on the computer screen one at a time. On some trials we will ask you to judge what emotion the person is SHOWING, and other times what emotion the person is FEELING, but I will tell you each time.

You'll only need to judge one emotion (HAPPINESS or SADNESS) at a time, but again I will tell you which one to concentrate on. You may see a number of pictures of the same person but try and consider each picture separately.

There are nine questions (blocks of photographs) in the task. Your job is to answer the question for each photograph by pressing A for YES or L for NO. For example, the first question might ask,

- "Is following person SHOWING happiness?"

You will press A key if you think YES they are *showing* happiness, or

You will press the L key if you think NO they are not *showing* happiness

The next question might ask,

- "Is the following person FEELING happiness?"

You will press the A key if you think YES they are actually *feeling* happiness, or

You will press the L key if you think NO they are not actually *feeling* happiness.

At the beginning of some questions (blocks of photographs) you will see a 7 digit number and you will be asked to remember this number and recall it to the experimenter at the end of the block. The instructions will let you know when it is a trial that you have to remember a number, and I will also remind you.

Each question (block) will begin with a short practice. Please read and follow the instructions on the screen

Please feel free to ask me any questions

Information Sheet

Recognising Facial expressions of Emotion

You are invited to take part in a study being conducted by researchers at the University of Canterbury. The project is being carried out as part of the requirements for a Master's thesis by Charlene Lang, under the supervision of Professor Lucy Johnston, Dr Janet Carter, & Dr Tracy McLellan.

We are interested in the relationship between people's thinking styles and their emotions and their perception of emotions in others. The researchers are interested in looking at relationships between responses to questionnaires about how people feel about themselves, mood, responding to events and responses to the tasks in the current study.

General Information

Your involvement in the study will take approximately 20-30 minutes and will be conducted at the University of Canterbury. We will give you some paper and pen questionnaires to complete that ask questions about how you feel about yourself and how you respond to life events and mood. We will then show you several photographs of people on a computer screen and ask you to respond to some questions about the people you see by pressing buttons on a keyboard. During some of the computer tasks, you will also be asked to complete some simple mental exercises, such as remembering a number during the task.

Confidentiality

The information you provide in this study will not be connected to your name, rather it will be coded by number to ensure the anonymity and confidentiality of the data. The data will be available only to the researchers. We will keep all coded information securely stored during the study and are required to safely archive this information once the study is completed.

Information regarding the findings of this study

The results of this study may be published but you will not be identified as a participant. You can request a summary of the results of this study although it may take some time for us to collect and analyze all of the data.

If any health concerns arise in the course of this study you may wish to discuss this information with your GP. However, information will not be passed to your GP without your consent.

Support Person

You are invited to bring a partner/friend /family member or support person with you. An adjacent room will be available for them to wait if you desire.

Participation

Your participation in this study is voluntary (your choice). You do not have to take part in this study, and you may choose to withdraw from the study at any time, without having to give any reason. Choosing to withdraw from the study will not result in any negative outcomes for you.

Reimbursement

We appreciate the time and effort required to participate in research and although we are unable to provide cash to participants, we can compensate you with a \$10 voucher as thanks for participation.

Please speak to the researcher if you have any further questions before participation

Please contact one of the researchers below if you have any queries or concerns about this study.

Contact details

Charlene Lang, University of Canterbury, Phone: 364 2987 extn. 7190;

Email: charlene.lang@pg.canterbury.ac.nz

Professor Lucy Johnston, University of Canterbury,

Phone (03) 3642987 extn. 6967

Dr Janet Carter, University of Canterbury, Phone (03) 3642987 extn. 8090

Dr Tracey McLellan, University of Canterbury,

Phone (03) 3642987 extn. 3632

The project has been reviewed and approved by the Upper South B Regional Ethics Committee, ethics reference number URB/10/04/016

Consent Form
Recognising Facial Expressions of Emotion

I have read and understand the information sheet for people volunteering to participate in the above named study. I have had the opportunity to discuss this study and I am satisfied with the answers I have been given. I have had the opportunity to use a support person to help me ask any questions and understand the study. I have had time to consider whether to take part in this study.

I understand that taking part in this study is voluntary (my choice) and that I may withdraw from the study at any time, for any reason without any consequences.

I understand that my participation in this study is confidential and no information that could identify me will be used in any reports generated on this study.

I agree to my GP being informed of the results of my participation in this study Please check: ☐ Yes ☐ No

Print name: _____

Participant's signature: _____

Date: _____

Project Explained By: _____

Project Role : _____

Date : _____

Contact details of researchers:

Charlene Lang Phone: 364 2987 extn. 7190;

Professor Lucy Johnston, Phone (03) 3642967

Dr Janet Carter, Phone (03) 3642987 extn. 8090

Dr Tracey McLellan, Phone (03) 3642987 extn. 3632

Appendix E: Participant Questionnaire Booklet

Demographic Data

(Today's Date:)

Age:

Sex (Circle one):

1 Female

2 Male

Number of Years of Education (including Tertiary):

Ethnicity of participant

Which ethnic group do you belong to?

Please circle the one(s) or enter another that applies to you.

1 New Zealand European

2 Māori

3 Samoan

4 Cook Island Māori

5 Tongan

6 Niuean

7 Chinese

8 Indian

9 OTHER Please state:

DASS

Please read each statement and circle a number 0, 1, 2 or 3 which indicates how much the statement applied to you *over the past week*. There are no right or wrong answers. Do not spend too much time on any statement.

The rating scale is as follows:

0 Did not apply to me at all

1 Applied to me to some degree, or some of the time

2 Applied to me a considerable degree, or a good part of the time

3 Applied to me very much, or most of the time

- | | | | | | |
|-----|---|---|---|---|---|
| 1. | I found myself getting upset by quite trivial things | 0 | 1 | 2 | 3 |
| 2. | I was aware of dryness of my mouth | 0 | 1 | 2 | 3 |
| 3. | I couldn't seem to experience any positive feeling at all | 0 | 1 | 2 | 3 |
| 4. | I experienced breathing difficulty (e.g. excessively rapid breathing, breathlessness in the absence of physical exertion) | 0 | 1 | 2 | 3 |
| 5. | I just couldn't seem to get going | 0 | 1 | 2 | 3 |
| 6. | I tended to over-react to situations | 0 | 1 | 2 | 3 |
| 7. | I had a feeling of shakiness (e.g. legs going to give way) | 0 | 1 | 2 | 3 |
| 8. | I found it difficult to relax | 0 | 1 | 2 | 3 |
| 9. | I found myself in situations that made me so anxious I was most relieved when they ended | 0 | 1 | 2 | 3 |
| 10. | I felt that I had nothing to look forward to | 0 | 1 | 2 | 3 |
| 11. | I found myself getting upset rather easily | 0 | 1 | 2 | 3 |
| 12. | I felt that I was using a lot of nervous energy | 0 | 1 | 2 | 3 |
| 13. | I felt sad and depressed | 0 | 1 | 2 | 3 |

- | | | | | | |
|-----|---|---|---|---|---|
| 14. | I found myself getting impatient when I was delayed in any way (e.g. lifts, traffic lights, being kept waiting) | 0 | 1 | 2 | 3 |
| 15. | I had feelings of faintness | 0 | 1 | 2 | 3 |
| 16. | I felt that I had lost interest in just about everything | 0 | 1 | 2 | 3 |
| 17. | I felt I wasn't worth much as a person | 0 | 1 | 2 | 3 |
| 18. | I felt that I was rather touchy | 0 | 1 | 2 | 3 |
| 19. | I perspired noticeably (e.g. hands sweaty) in the absence of high temperatures or physical exertion | 0 | 1 | 2 | 3 |
| 20. | I felt scared without any good reason | 0 | 1 | 2 | 3 |
| 21. | I felt that life wasn't worth while | 0 | 1 | 2 | 3 |
| 22. | I found it hard to wind down | 0 | 1 | 2 | 3 |
| 23. | I had difficulty in swallowing | 0 | 1 | 2 | 3 |
| 24. | I couldn't seem to get any enjoyment out of the things I did | 0 | 1 | 2 | 3 |
| 25. | I was aware of the action of my heart in the absence of physical exertion (e.g. sense of heart rate increase, heart missing a beat) | 0 | 1 | 2 | 3 |
| 26. | I felt down-hearted and blue | 0 | 1 | 2 | 3 |
| 27. | I found that I was very irritable | 0 | 1 | 2 | 3 |
| 28. | I felt I was close to panic | 0 | 1 | 2 | 3 |
| 29. | I found it hard to calm down after something upset me | 0 | 1 | 2 | 3 |
| 30. | I feared that I would be "thrown" by some trivial but unfamiliar task | 0 | 1 | 2 | 3 |
| 31. | I was unable to become enthusiastic about anything | 0 | 1 | 2 | 3 |

- | | | | | | |
|-----|---|---|---|---|---|
| 32. | I found it difficult to tolerate interruptions to what I was doing | 0 | 1 | 2 | 3 |
| 33. | I was in a state of nervous tension | 0 | 1 | 2 | 3 |
| 34. | I felt I was pretty worthless | 0 | 1 | 2 | 3 |
| 35. | I was intolerant of anything that kept me from getting on with what I was doing | 0 | 1 | 2 | 3 |
| 36. | I felt terrified | 0 | 1 | 2 | 3 |
| 37. | I could see nothing in the future to be hopeful about | 0 | 1 | 2 | 3 |
| 38. | I felt that life was meaningless | 0 | 1 | 2 | 3 |
| 39. | I found myself getting agitated | 0 | 1 | 2 | 3 |
| 40. | I was worried about situations in which I might panic and make a fool of myself | 0 | 1 | 2 | 3 |
| 41. | I experienced trembling (e.g. in the hands) | 0 | 1 | 2 | 3 |
| 42. | I found it difficult to work up the initiative to do things | 0 | 1 | 2 | 3 |

RSQ-R

People think and do many different things when they feel *depressed*. Please read each of the items below and indicate whether you never, sometimes, often, or always think or do each one when you feel down, sad, or depressed. Please indicate what you *generally* do, not what you think you should do. Please circle one.

- 1) I think about my feelings of fatigue and achiness
never sometimes often always
- 2) I think about how passive and unmotivated I feel
never sometimes often always

- 3) I think “I won’t be able to do my job/work because I feel so badly”
never sometimes often always
- 4) I think about how I don’t feel up to doing anything
never sometimes often always
- 5) I think about how hard it is to concentrate
never sometimes often always
- 6) I think about how alone I feel
never sometimes often always
- 7) I think about how I don’t seem to feel anything any more
never sometimes often always
- 8) I go someplace alone to think about my feelings
never sometimes often always
- 9) I isolate myself and think about the reasons why I feel sad
never sometimes often always
- 10) I go away by myself and think about why I feel this way
never sometimes often always
- 11) I write down what I am thinking about and analyze it
never sometimes often always
- 12) I listen to sad music
never sometimes often always
- 13) I think “Why do I always react this way?”
never sometimes often always
- 14) I think about a recent situation wishing it had gone better
never sometimes often always
- 15) I think about how angry I am with myself
never sometimes often always
- 16) I try to understand myself by focusing on my depressed feelings
never sometimes often always

- 17) I analyse my personality to try and understand why I am depressed
never sometimes often always
- 18) I analyse recent events to try and understand why I am depressed
never sometimes often always
- 19) I think about all my shortcomings, failings, faults, mistakes
never sometimes often always
- 20) I think about how sad I feel
never sometimes often always
- 21) I think "Why can't I get going?"
never sometimes often always
- 22) I think "Why do I have problems other people don't have?"
never sometimes often always
- 23) I think "Why can't I handle things better?"
never sometimes often always
- 24) I think "I won't be able to concentrate if I keep feeling this way."
never sometimes often always
- 25) I think "What am I doing to deserve this?"
never sometimes often always

Thank you for completing the questionnaires, please return your completed forms to the researcher and you will proceed to the next part of the study.

Debriefing Form

Recognising Facial expressions of Emotion

Thank you for taking the time to participate in this study, below is some information about the study, which the researcher will go over with you. If you have any questions or need any clarification please do not hesitate to ask the researcher.

This study examined whether or not there is a relationship between people's mood and emotions in terms of symptoms of depression, their thinking style in terms of levels of rumination and the ability to tell the difference between posed and genuine expression of emotions. Rumination is the repetitive focus on problems in one's life and dwelling on the negative impact of these problems. A genuine expression of emotion is one where the person is feeling the emotion that they are displaying in their facial expression, while for a posed expression the person displays an emotion on their face but is not actually experiencing/feeling that emotion (e.g., smiling despite not actually feeling happy).

This study also examined two mechanisms that might explain the relationship between depressive symptoms, rumination and the detection of emotion. One of these mechanisms is intentional processing of social information. The other mechanism is inattention to social information.

We are predicting that levels of depressive symptoms and rumination will effect people's ability to tell the difference between posed and genuine facial expressions of emotion. Specifically higher levels of depressive symptoms and/or rumination will be associated with poorer ability to differentiate between posed and genuine expression of happiness but greater ability to differentiate between genuine and posed expressions of sadness. We are also predicting that the two mechanisms will show underlying relationships with both symptoms of depression and levels of rumination.

We used computer tasks asking participants to make judgements about facial photographs to measure emotion perception. To measure depressive symptoms and level of rumination we used self report questionnaires.

We looked at the underlying mechanisms two different ways. To look at intentional processing, we attempted to prevent this processing by giving participants a mental task (remembering a number) during the faces task. We are predicting when performing the task under this condition, we will not see significant relationships between depression,

rumination and the ability to differentiate between posed and genuine expressions of emotion.

To look at inattention to social information we asked participants to complete a recognition exercise. In the recognition exercise there were faces that were present in the experimental task (familiar faces) and faces that were not (unfamiliar faces), participants were asked to identify which faces were familiar. We are predicting that those with higher levels of depression and/or rumination will have poorer recognition of facial expressions of happiness, but a greater ability to recognise facial expressions of sadness.

This research may allow us to better understand emotion perception and the impact rumination and depressive symptoms have on emotional awareness processes.

You can request a summary of the results of this study from the researchers although it may take some time for us to collect and analyse all of the data. If you have any further questions please contact the researcher.

Contact details

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Appendix G: Analysis of Variance (ANOVA) analyses for percentage YES responses

A 2 (Cognitive load: no load/load) x 3 (Emotion: happy/sad) x 2 (Condition: show/feel) x 3 (Expression: genuine/posed/neutral) repeated measures ANOVAs displayed main effects of Condition, $F(1, 99) = 76.71, p < 0.001, \eta^2_p = .440$ and Expression, $F(2, 198) = p < .001, \eta^2_p = .899$. These main effects were qualified by significant Emotion by Expression, $F(2, 198) = 164.10, p < .001, \eta^2_p = .636$ and Condition by Expression $F(2, 198) = 97.920, p < .001, \eta^2_p = .499$ interactions, there was also significant Load by Emotion by Condition $F(1, 99) = 4.10, p < .05, \eta^2_p = .040$, Load by Condition by Expression $F(2, 198) = 5.41, p < .01, \eta^2_p = .052$, and Emotion by Condition by Expression $F(2, 198) = 3.73, p < .05, \eta^2_p = .037$ three way interactions. A significant four way interaction was found $F(2, 198) = 3.75, p < .05, \eta^2_p = .038$

In light of the revealed 3 and 4 way interactions a separate 2 (Cognitive Load: no load/load) x 2 (Condition: show/fee) x 3 (Expression: genuine/posed/neutral) repeated measures ANOVAs was conducted for each emotion. For happiness, analysis displayed main effects of Condition $F(1, 99) = 68.07, p < .01, \eta^2_p = .410$ and Expression $F(2, 198) = 1374.80, p < .01, \eta^2_p = .933$ these were qualified by significant Load by Condition $F(1, 99) = 6.51, p < .05, \eta^2_p = .062$ and Condition by Expression $F(2, 198) = 86.79, p < .001, \eta^2_p = .470$ interactions. A significant three way interaction was also found $F(2, 198) = 10.85, p < .01, \eta^2_p = .100$.

In light of the 3 way interaction in the analysis for happiness, separate 2 (Load: no load/load) x 2 (Expression: genuine/posed/neutral) repeated measures ANOVAs were conducted. For the show condition, analysis displayed main effects of Load F

$(1, 99) = 5.90, p < .01, \eta^2_p = .057$ and Expression $F(2, 198) = 1418.83, p < .01, \eta^2_p = .935$ these were qualified by a significant interaction $F(2, 198) = 7.96, p < .01, \eta^2_p = .075$ which is shown in Figure 6. Post-hoc tests (Tukey, $p < .05$) were conducted to investigate the interaction. In both load conditions sensitivity to genuine expressions was significantly higher than posed expressions, with both being higher than for neutral expressions. Therefore, genuine expressions were judged as being happy in both the show and feel condition equally as often, while posed expressions were only judged as happy more often when asked if targets were showing happiness, then when asked if participants were feeling happy. The interaction revealed no significant difference in the percentage of YES responses to happiness in the no load and load conditions for either genuine ($M = 95\%$ vs. 95.5%), or neutral ($M = 7.5\%$ vs. 7.4%) expressions. There were, however, more YES responses to posed expressions in the no load than the load ($M = 90.8\%$ vs. 83.3%) condition. When participants completed the task without being under cognitive load there was not a significant difference between percentage YES responses to genuine and posed expressions ($M = 95\%$ vs. 90.8%), but both were significantly higher than neutral expressions. When completing the task under a cognitive load YES responses to genuine expressions were significantly higher than responses for posed, and both were significantly higher than neutral expressions. In the show condition while under a cognitive load participants showed more discrimination between posed and genuine expressions as displaying happiness.

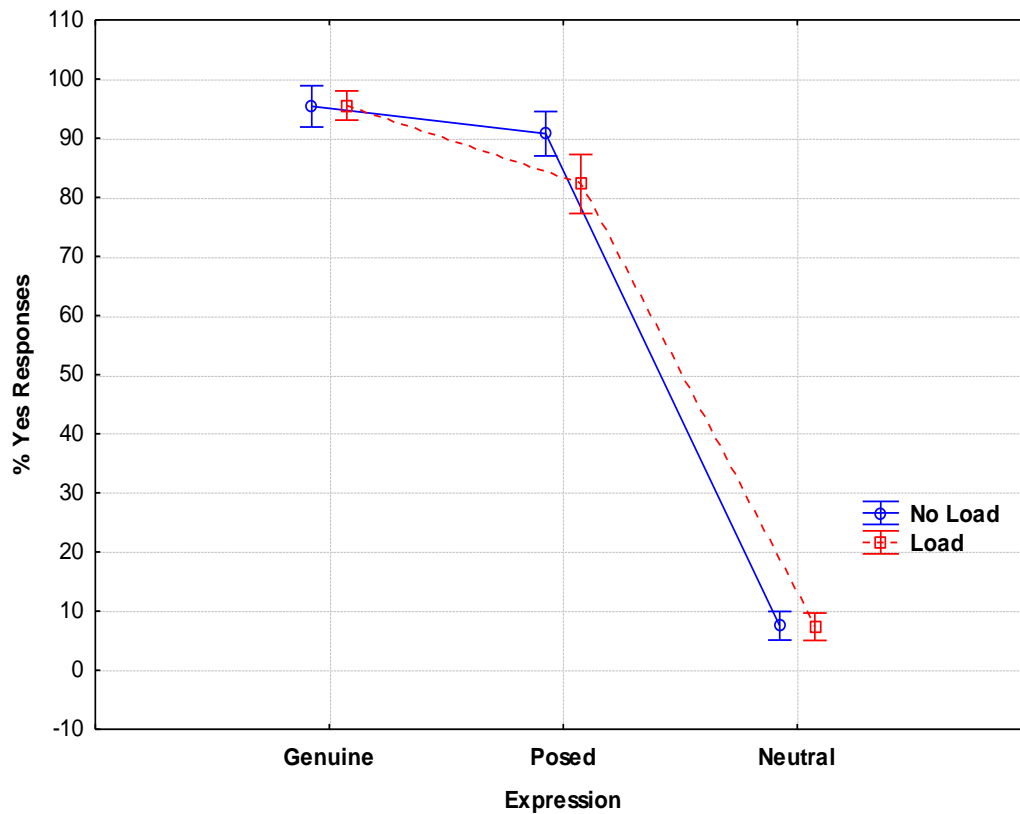


Figure 6. Percentage YES Responses to Happiness as a Function of Expression Type and Load in the Show Condition.

For happiness in the feel condition analysis displayed main effects of Expression $F(2,198) = 548.31, p < .001, \eta^2_p = .847$ which was qualified by an interaction $F(2,198) = 3.58, p < .05, \eta^2_p = .030$ which is shown in Figure 7. Post-hoc tests (Tukey, $p < .05$) were conducted to investigate the interaction. In both load conditions YES responses to emotion to genuine expressions was significantly higher than posed expressions, with both being higher than for neutral expressions. The interaction revealed no significant difference in the percentage of YES responses to happiness in either load condition for genuine ($M = 94.1\%$ vs. 92.8%), or neutral ($M = 9.1\%$ vs. 9.3%) expressions. However, there were more YES responses to posed expressions in the load condition compared to the no load condition ($M = 56.4\%$ vs. 51.3%). While under a cognitive load participants made more judgements of posed

expressions as feeling happiness than when completing the task without a cognitive load.

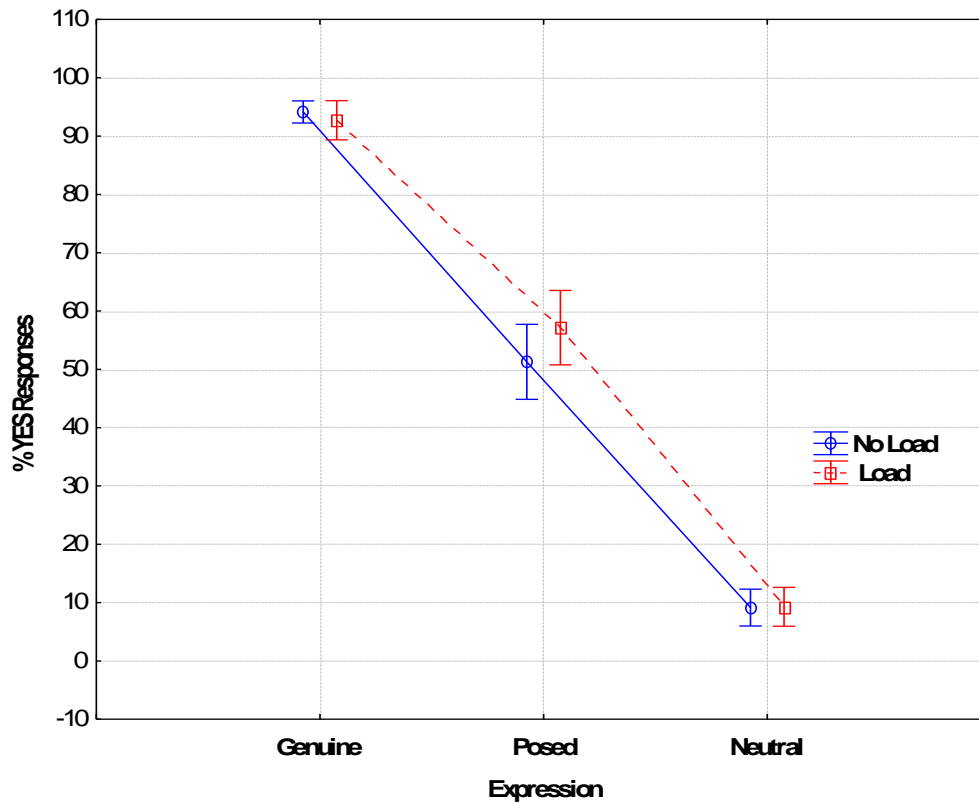


Figure 7. Percentage YES Responses to Happiness as a Function of Expression Type and Load in the Feel Condition.

For sadness, analysis displayed main effects of Condition $F(1, 99) = 40.57, p < .001$, $\eta^2_p = .291$ and Expression $F(2, 198) = 197.03, p < .001$, $\eta^2_p = .666$, these were qualified by a significant Condition by Expression interaction $F(2, 198) = 51.56, p < .001$, $\eta^2_p = .342$ which is shown in Figure 8. Post-hoc tests (Tukey, $p < .05$) were conducted to investigate the interaction. The interaction revealed significant difference in the percentage of YES responses to sadness in the show and feel conditions for genuine ($M = 83.6\%$ vs. 75.8%) and posed ($M = 70.5\%$ vs. 41.4%) expressions. There was no significant difference in YES responses to neutral ($M = 31.4\%$ vs. 35%) expressions in the show and feel conditions. In the both the show

and feel conditions the percentage YES responses to genuine expressions were significantly higher than posed expressions and both were significantly higher than neutral expressions. Participants more often judged genuine expressions as both showing and feeling sadness but posed emotions as only showing the emotion.

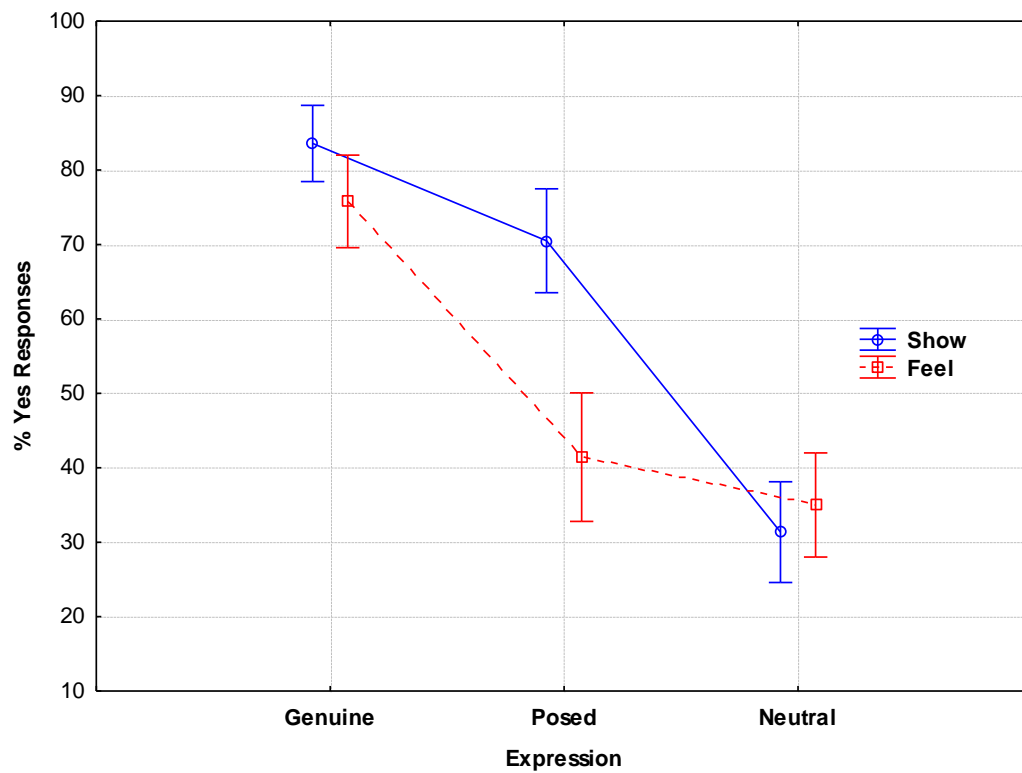


Figure 8. Percentage YES Responses to Sadness as a Function of Expression Type and Condition

Appendix H: Formulae used for calculation of sensitivity and bias

Sensitivity (A'):

- For $H \geq FA$: $A' = 0.5 + [(H - FA)(1 + H - FA)] / [4H(1-FA)]$
- For $FA > H$: $A' = 0.5 - [(FA - H)(1 + FA - H)] / [4FA(1-H)]$

Response bias (B''):

- For $H \geq FA$: $B'' = [H(1 - H) - FA(1 - FA)] / [(H(1 - H) + FA(1 - FA))]$
- For $FA > H$: $B'' = [FA(1 - FA) - H(1 - H)] / [(FA(1 - FA) + H(1 - H))]$

H = hit rate, and FA = false alarm rate.